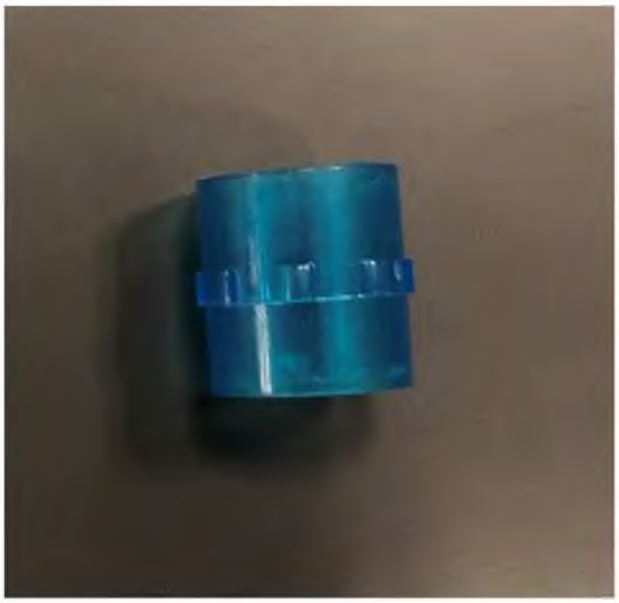


IMAGE 7 – 22 mm Adaptor

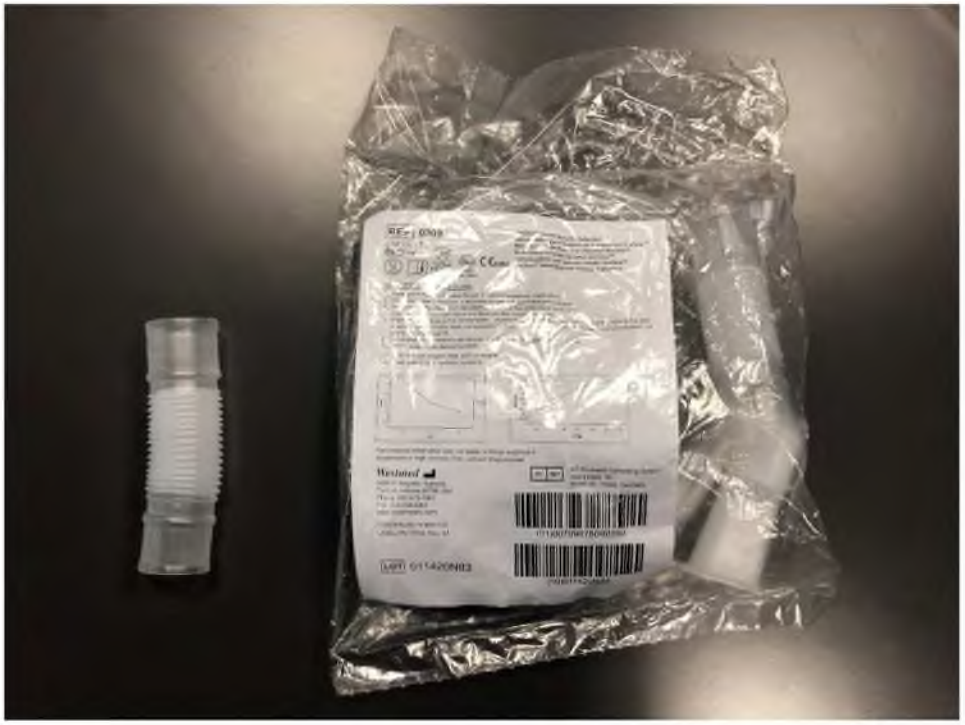


IMAGE 8 - Short corrugated tube from small volume jet nebulizer

IMAGE 9 - Cut piece of standard large bore tubing

IMAGE 10 – CPVC ¾ inch Tee

IMAGE 11 - Hospital sourced 15 mm adapters

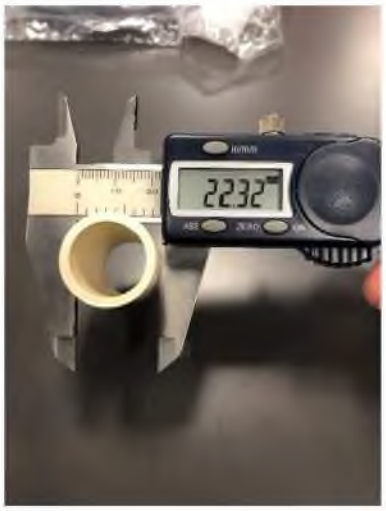


IMAGE 12 - ¾ CPVC pipe cut to 4 cm

Training and Resources

FAQs: (FEMA link). We hope to have this up soon

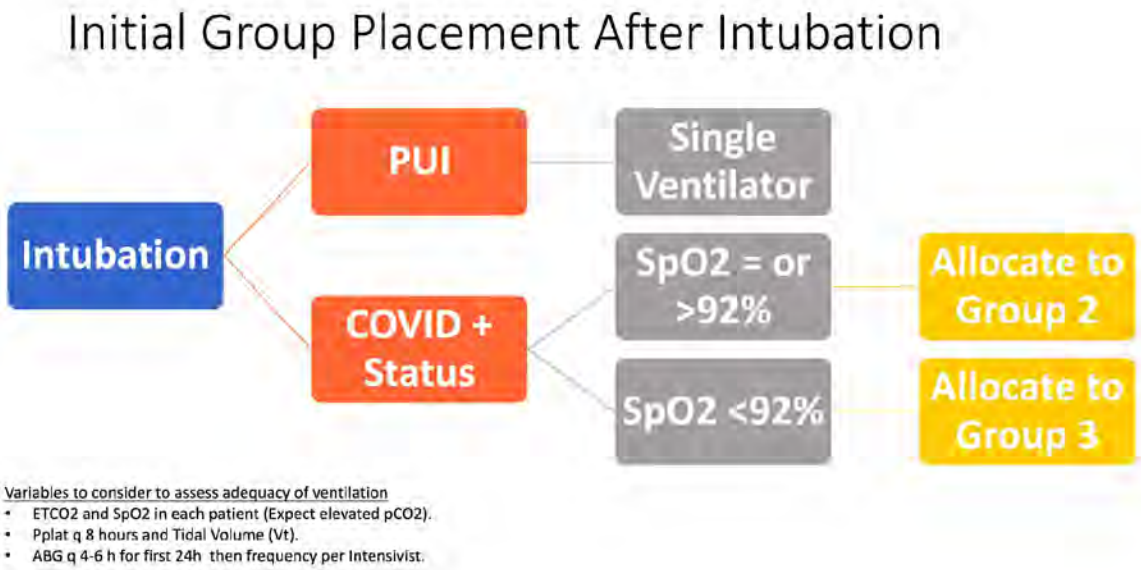
Video tutorial: available here. https://youtu.be/UkSwRC7Qstk

24-hr. telephone support for implementation guidance is expected soon.

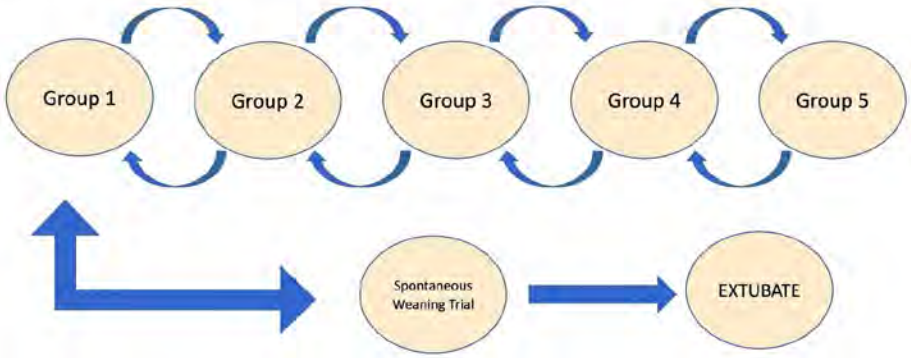
Database for tracking clinical experience: follow link to portal to enter patient information (FEMA portal)

Conclusion

In light of the ongoing Covid -19 pandemic, the need for mechanical ventilators across the United States may become dire. In this situation it is incumbent on medical providers and governing bodies to explore and support new strategies to provide the best possible care. This document provides a way to potentially modify a single ventilator for off label use to co-ventilate 2 patients based on animal data and limited human experience. As this is a unique use of a mechanical ventilator being used during a pandemic crisis, sharing feedback of implementation experiences, limitations and challenges is strongly encouraged. Please follow the link to the FEMA portal to share experience.



Group Transitions



Considerations

- Always set ventilator to 100% FiO2 when a patient is being added to a new group until further assessed (see text).
- Criteria for Transition between groups per measured parameters (ABG, SpO2, Vt and ETCO2). *See text.*

PC Settings and PEEP By Group

Group	PC	FIO2	PEEP
2	20-25	40	10
3	25-30	90	14
4	30-35	100	18
5	35-40*	100	22

Group 1: Patients deemed appropriate for weaning using 40% O_2/+5 PEEP

Determine Group mobility using:
ABG/VBG, Pplat, VT (if measurable), ETCO2, SaO2

*Group 5 patients with persistent failure → consider IRV

COVID19 (b) (5)

From: "Kjelland, Christin C. EOP/OSTP" (b) (6)

To: "Watson, Ian D. EOP/OSTP" (b) (6) "Waterman, Paige E. EOP/OSTP" (b) (6), "Simon, Ian D. EOP/OSTP (Contractor)" (b) (6)

Date: Fri, 27 Mar 2020 10:29:05 -0400

Attachments: COVID19 (b) (5) kB); COVID-19 Vaccines_16Mar - countries (addition SPAIN).xlsx (19.92 kB)

Hi Paige, Ian, Ian,

(b) (5)

Hope this is helpful,
Christin

RE: CS Call

From: "Kjelland, Christin C. EOP/OSTP" (b) (6)

To: "Droegemeier, Kelvin K. EOP/OSTP" (b) (6), "Casey, Winter EOP/OSTP" (b) (6)

Date: Sat, 28 Mar 2020 15:26:33 -0400

Attachments: COVID19 Research(b) (5) kB)

Hi Kelvin,

Great – thank so much.

(b) (5)

(b) (5). I will ask Rebecca if there is an updated version.

Best wishes!
Christin

From: Droegemeier, Kelvin K. EOP/OSTP <(b) (6)
Sent: Saturday, March 28, 2020 11:20 AM
To: Kjelland, Christin C. EOP/OSTP (b) (6) Casey, Winter EOP/OSTP (b) (6)
Cc: Droegemeier, Kelvin K. EOP/OSTP (b) (6)
Subject: CS Call

Hi Christin and Winter,

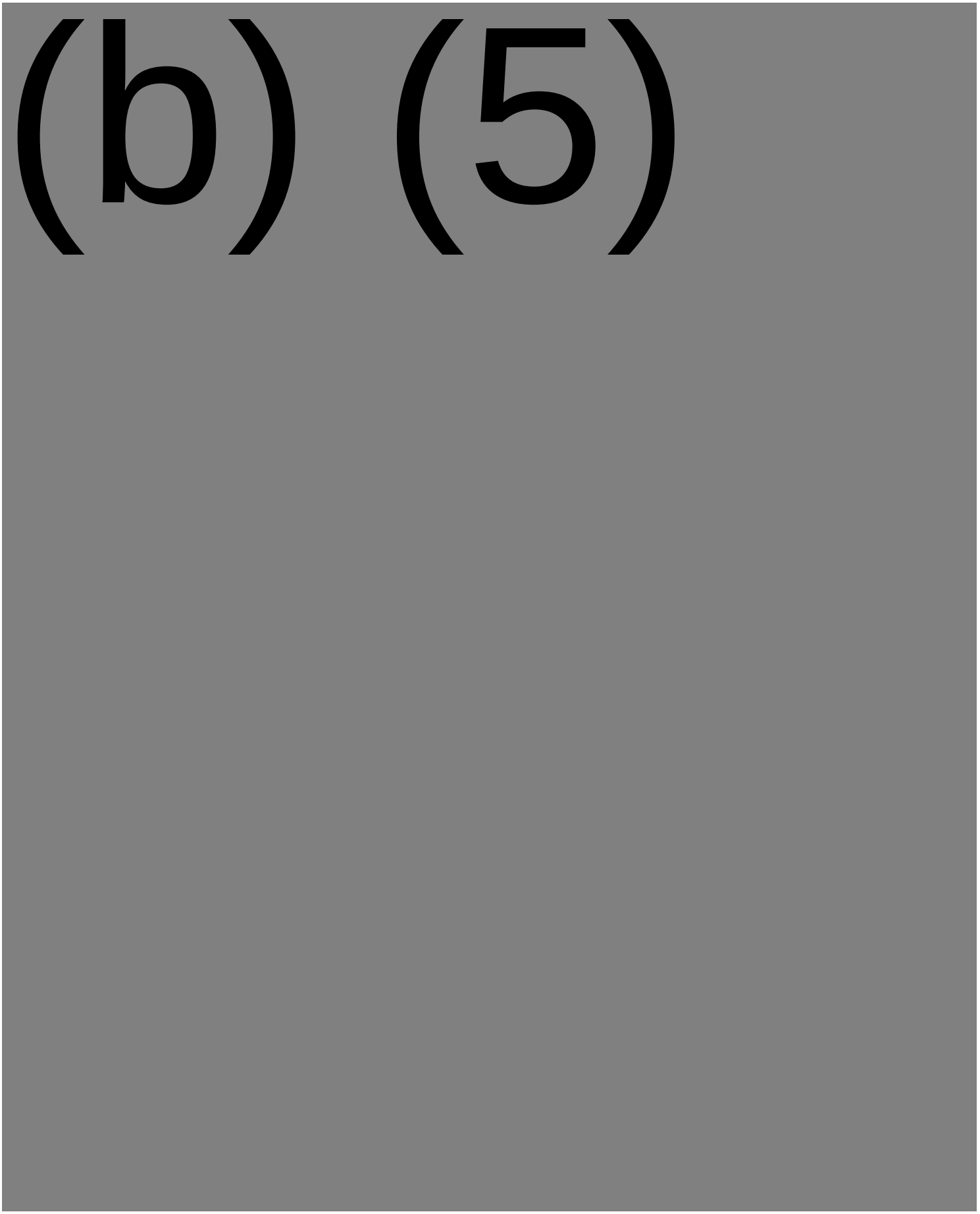
(b) (5)

Thanks!

Kelvin

Dr. Kelvin K. Droegemeier, Director
Office of Science and Technology Policy
The White House
Washington, DC 20502
(202) 456-4444
http://www.ostp.gov
@WHOSTP

(b) (5)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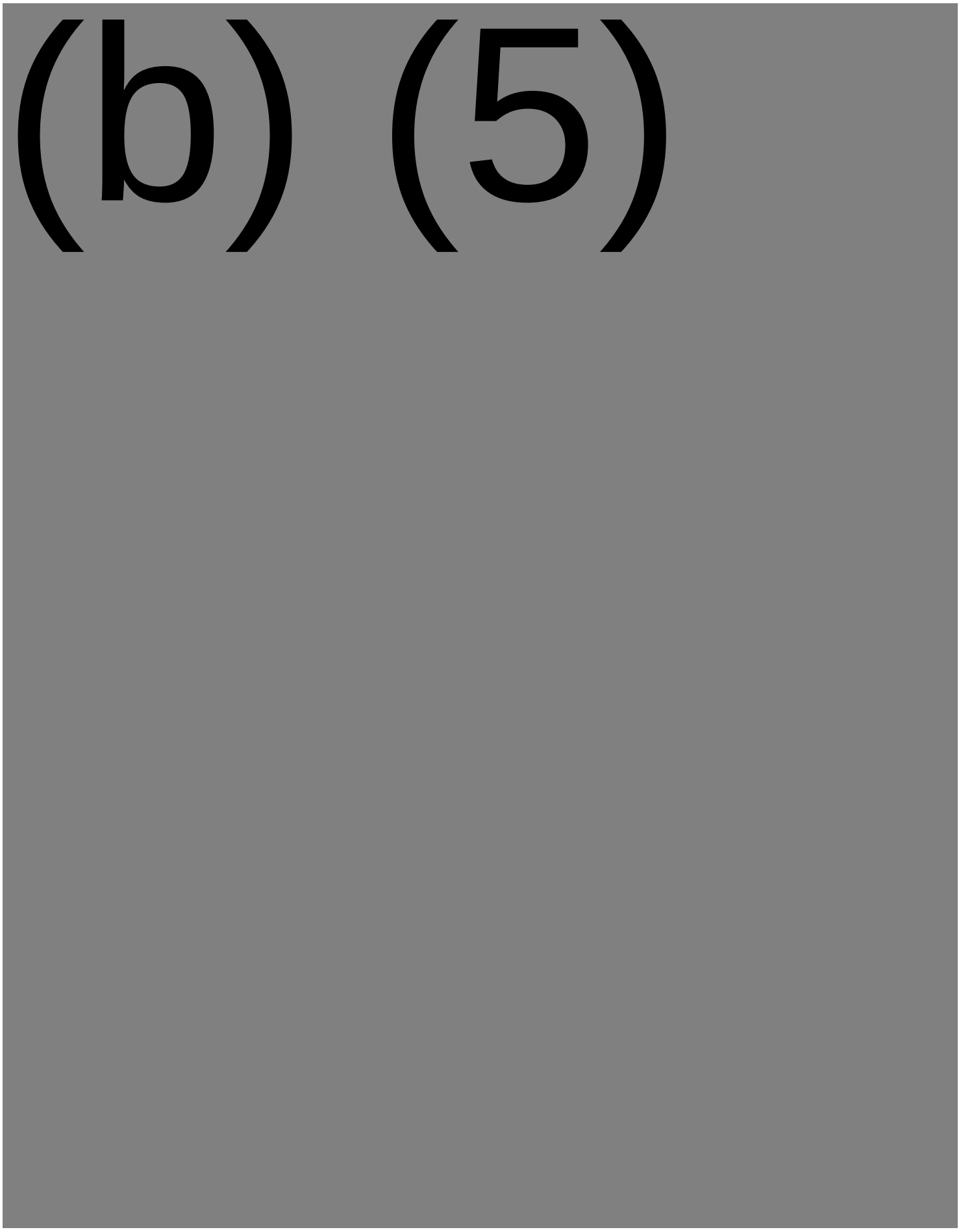
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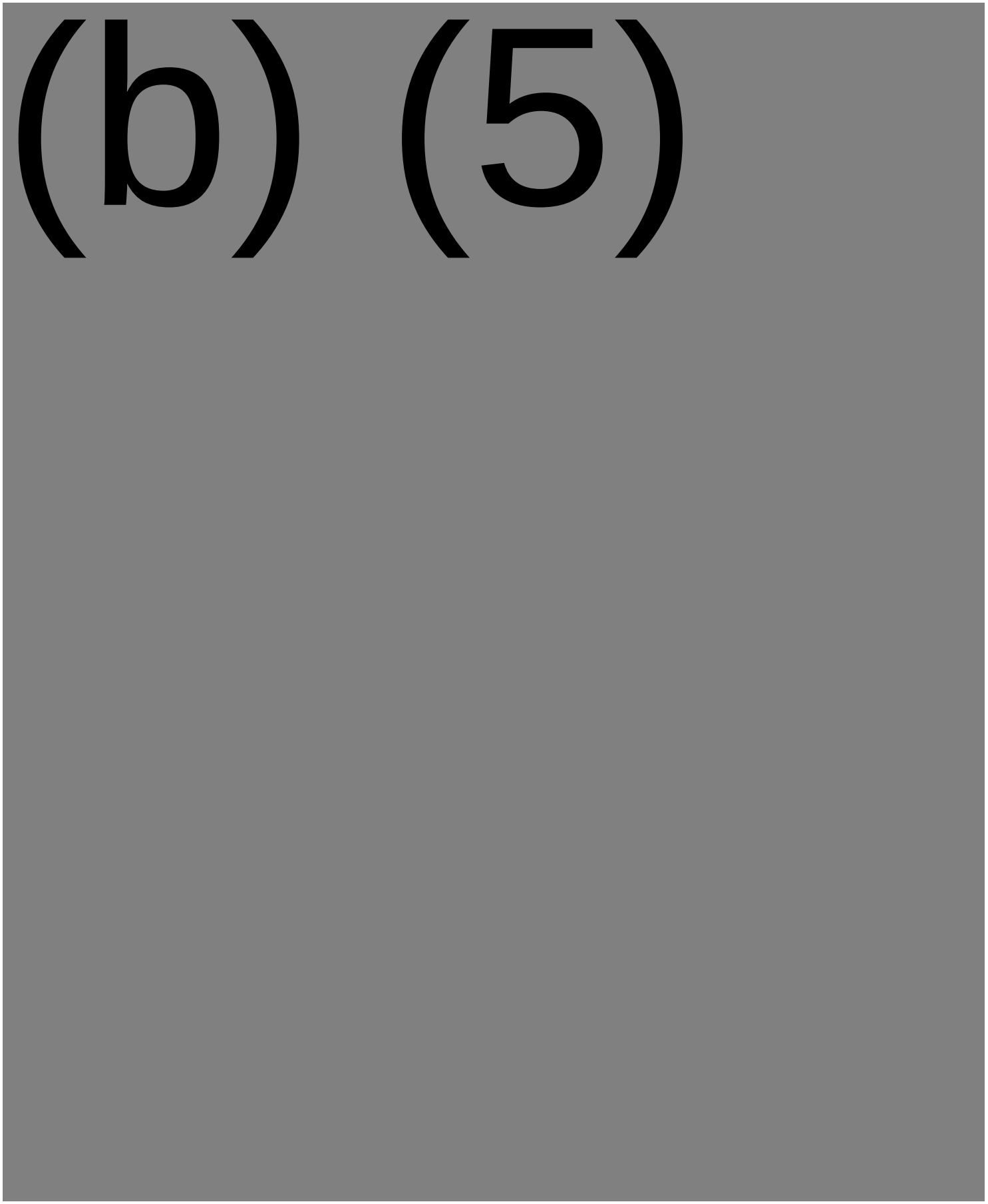
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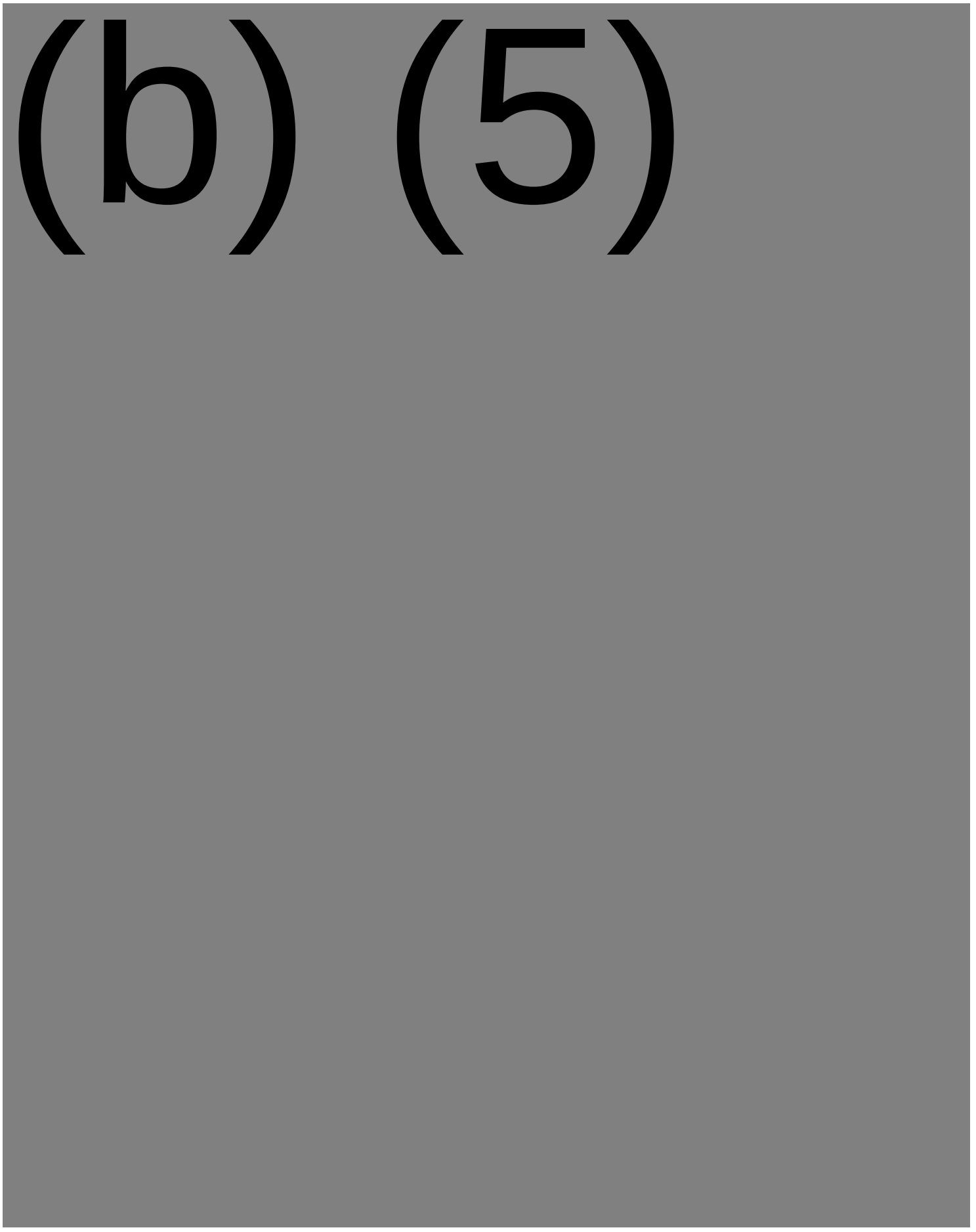
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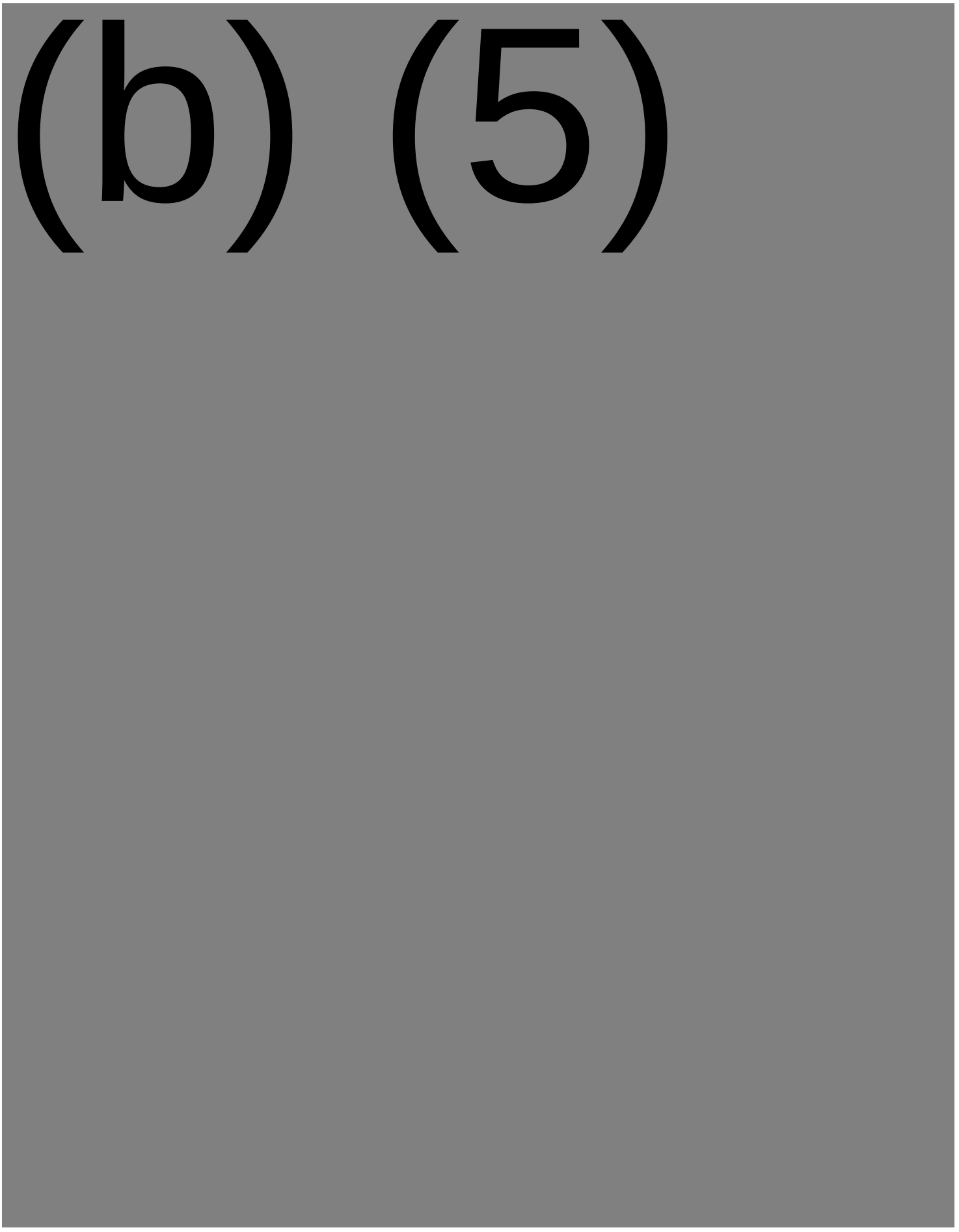
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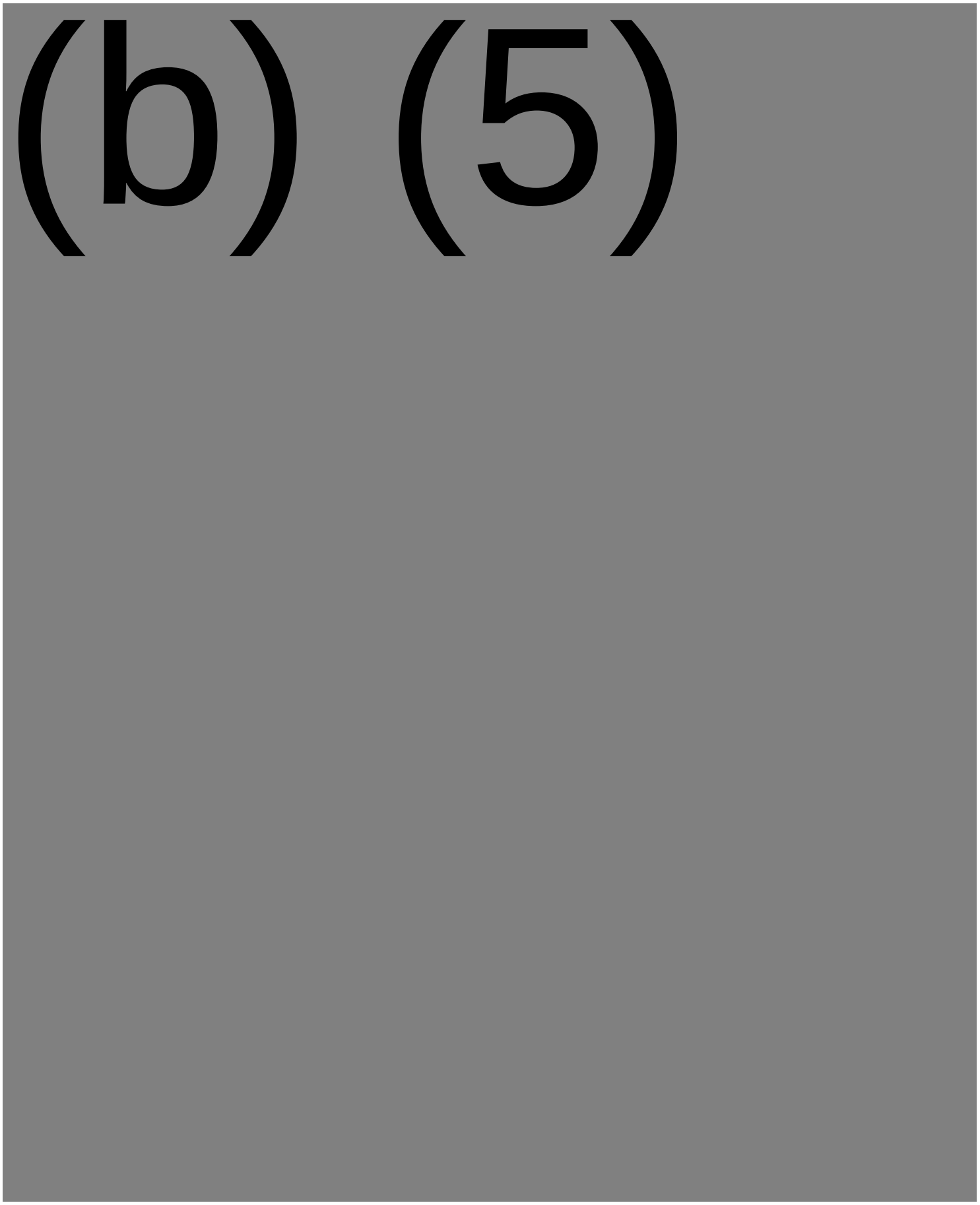
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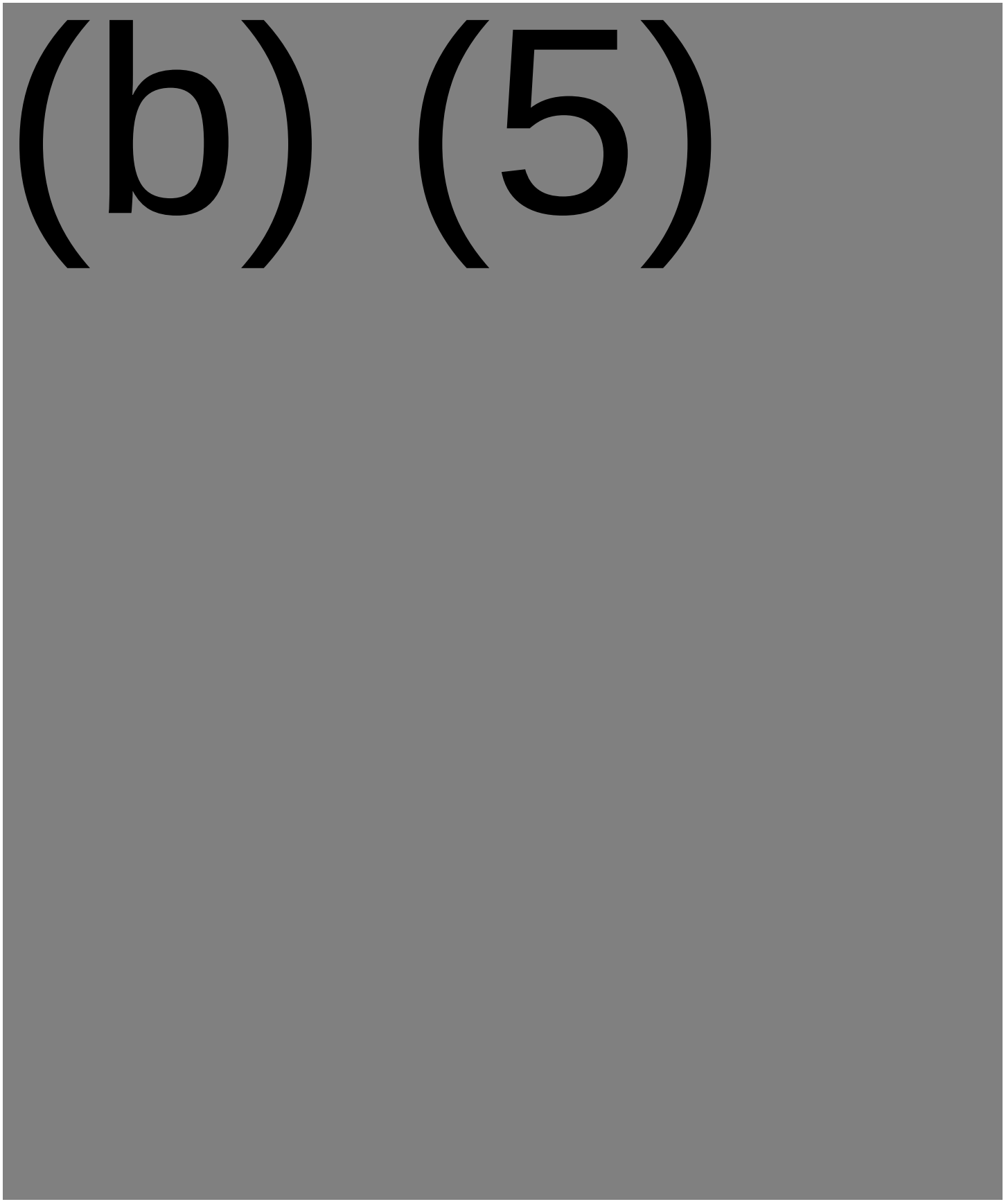
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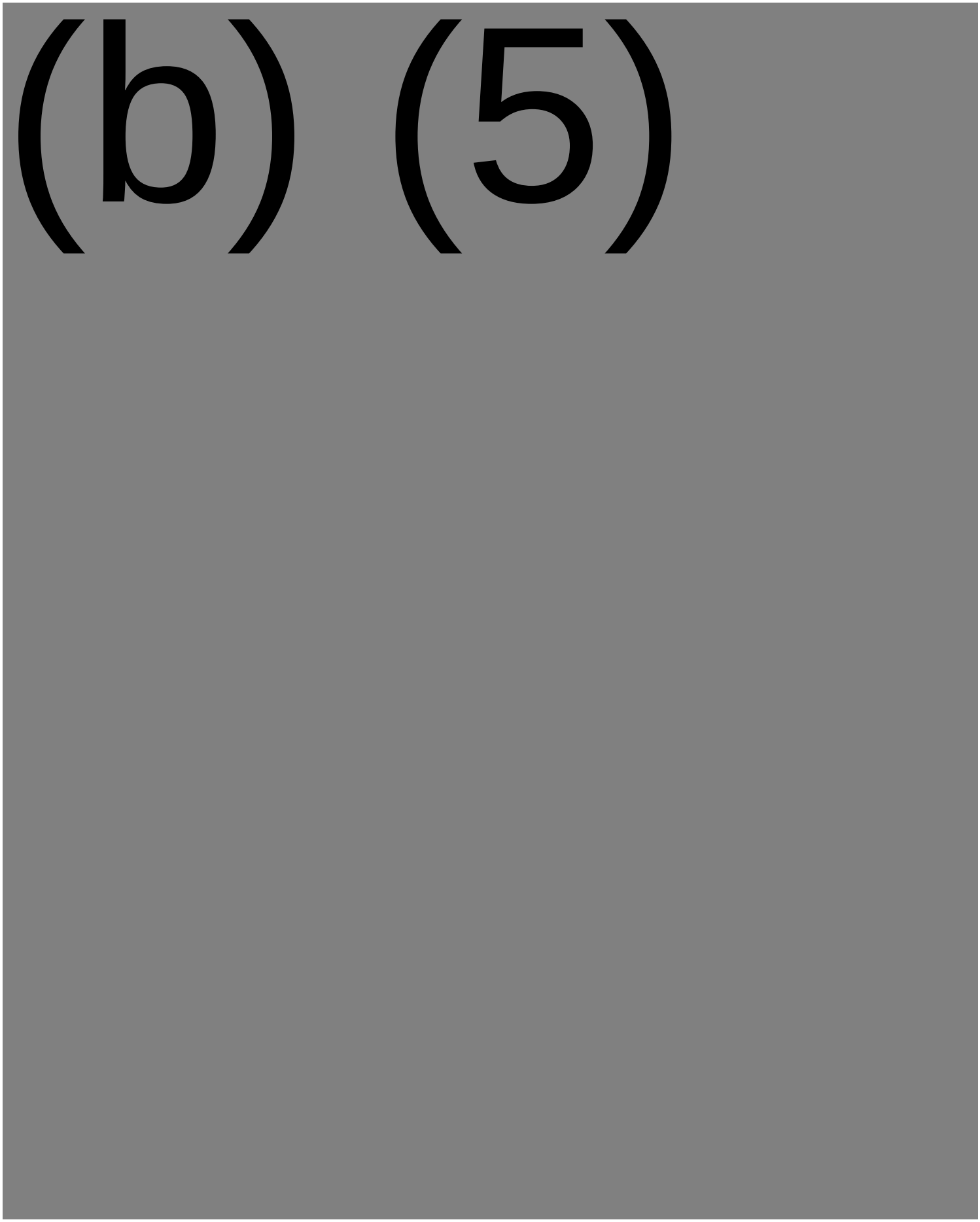
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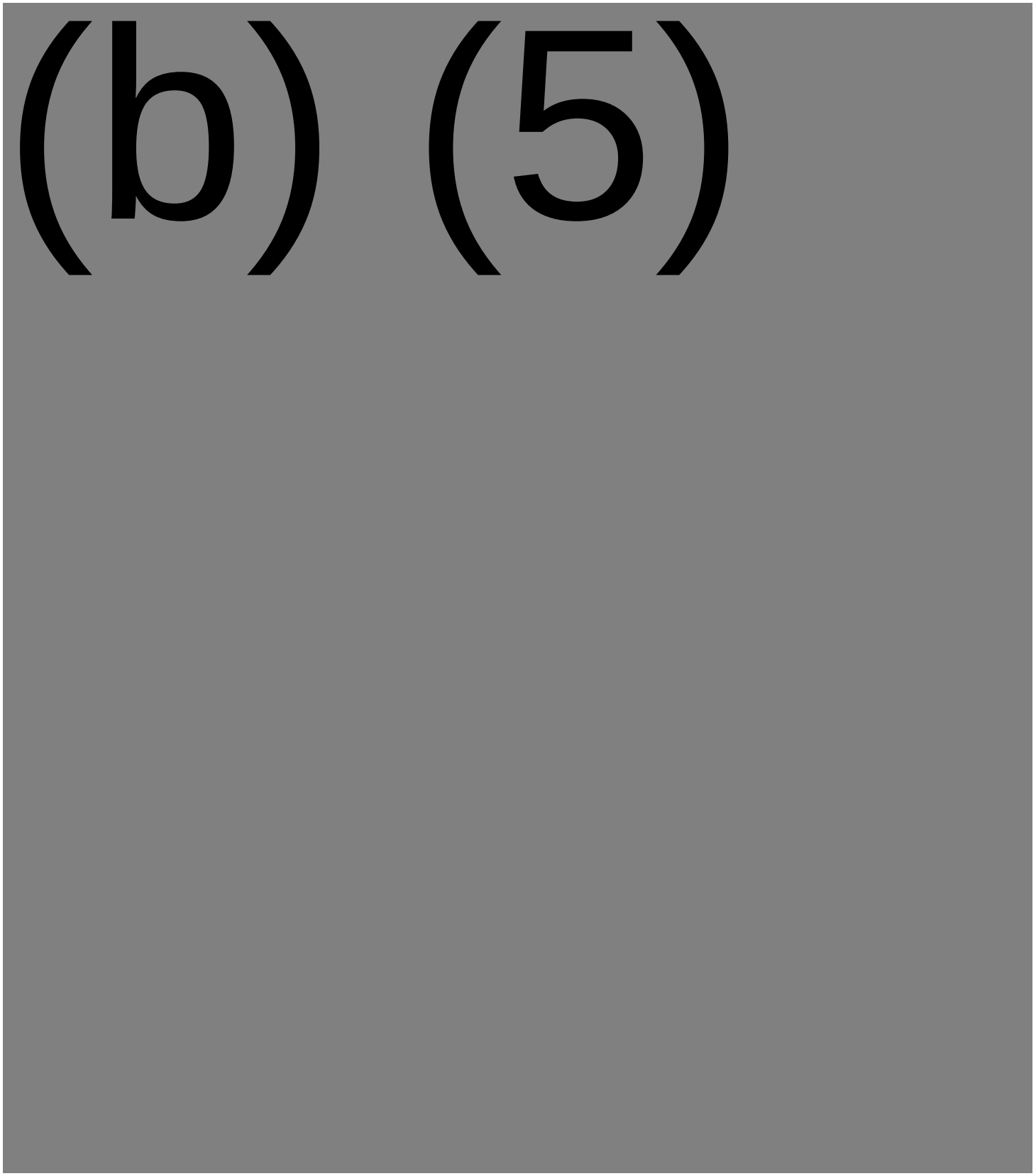

(b) (5)

CSA call -(b) (5)

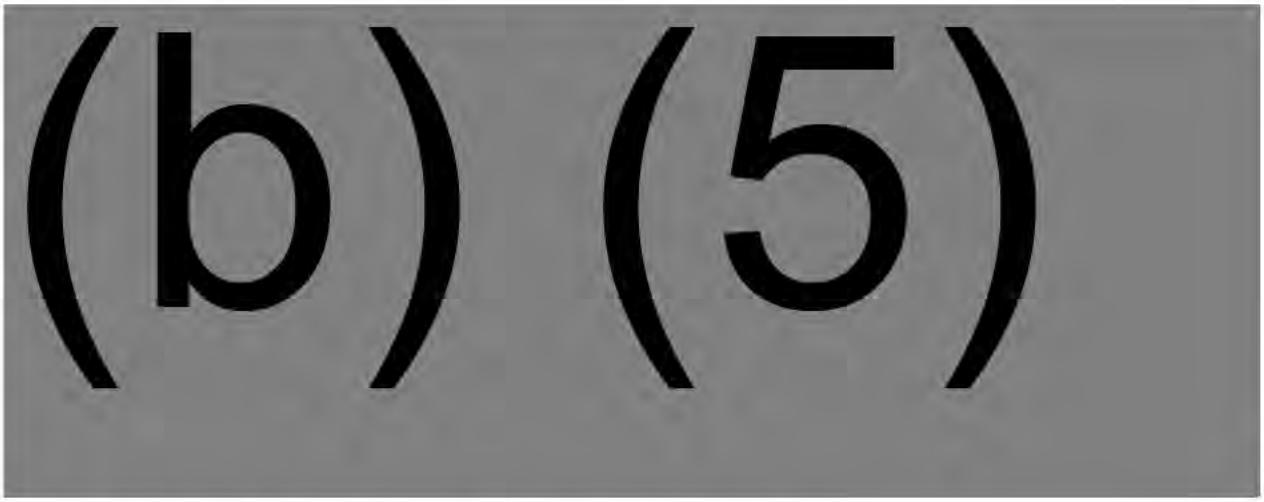
From: "Kjelland, Christin C. EOP/OSTP" (b) (6)

To: "Simon, Ian D. EOP/OSTP (Contractor)" (b) (6) "Watson, Ian D. EOP/OSTP" (b) (6)

Date: Sat, 28 Mar 2020 15:51:57 -0400

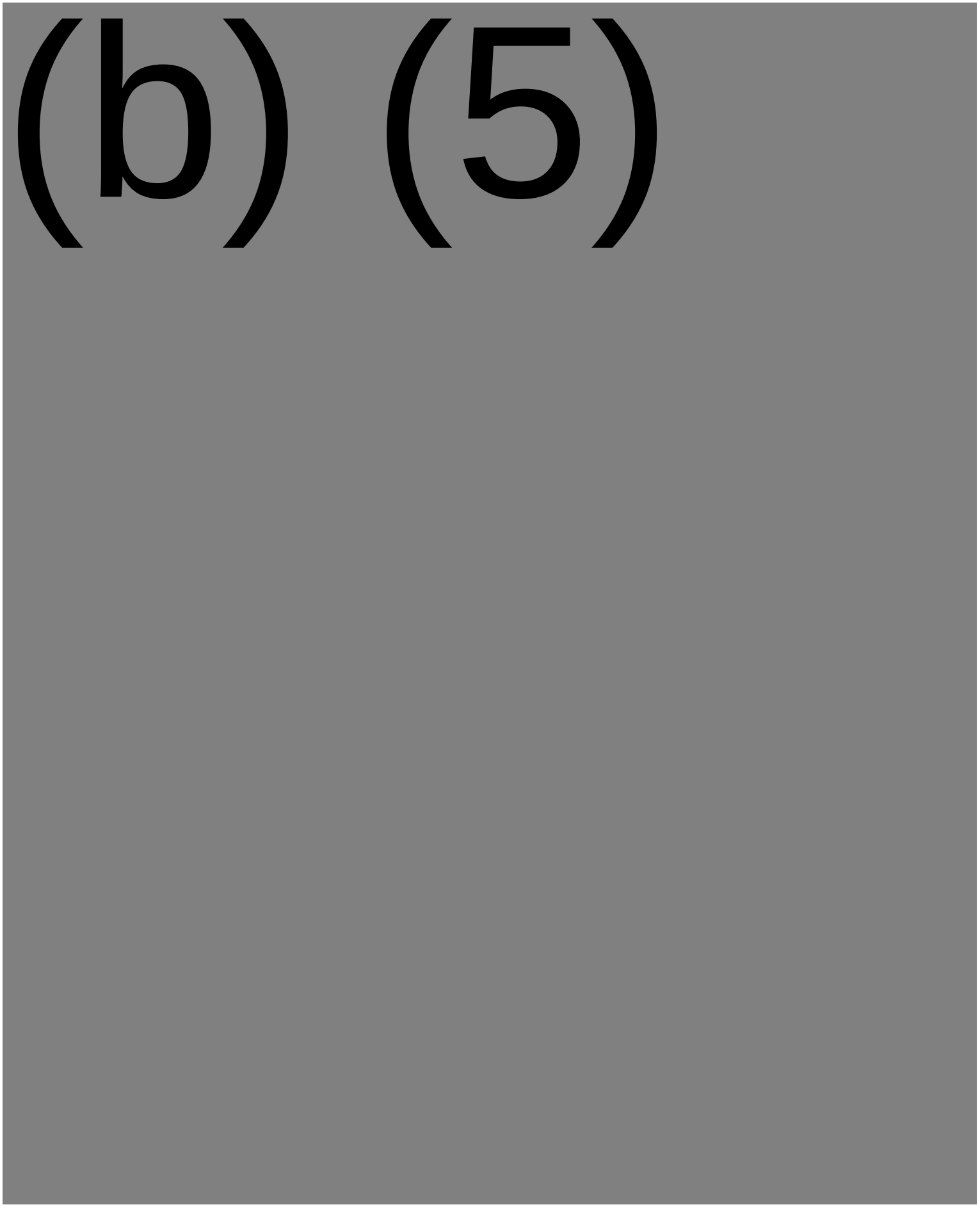
Attachments: COVID19 Research(b) (5) 1 kB)

Hi Ian (and Ian),



Thank you so much! Hope that you're getting some rest this weekend!

Best,
Christin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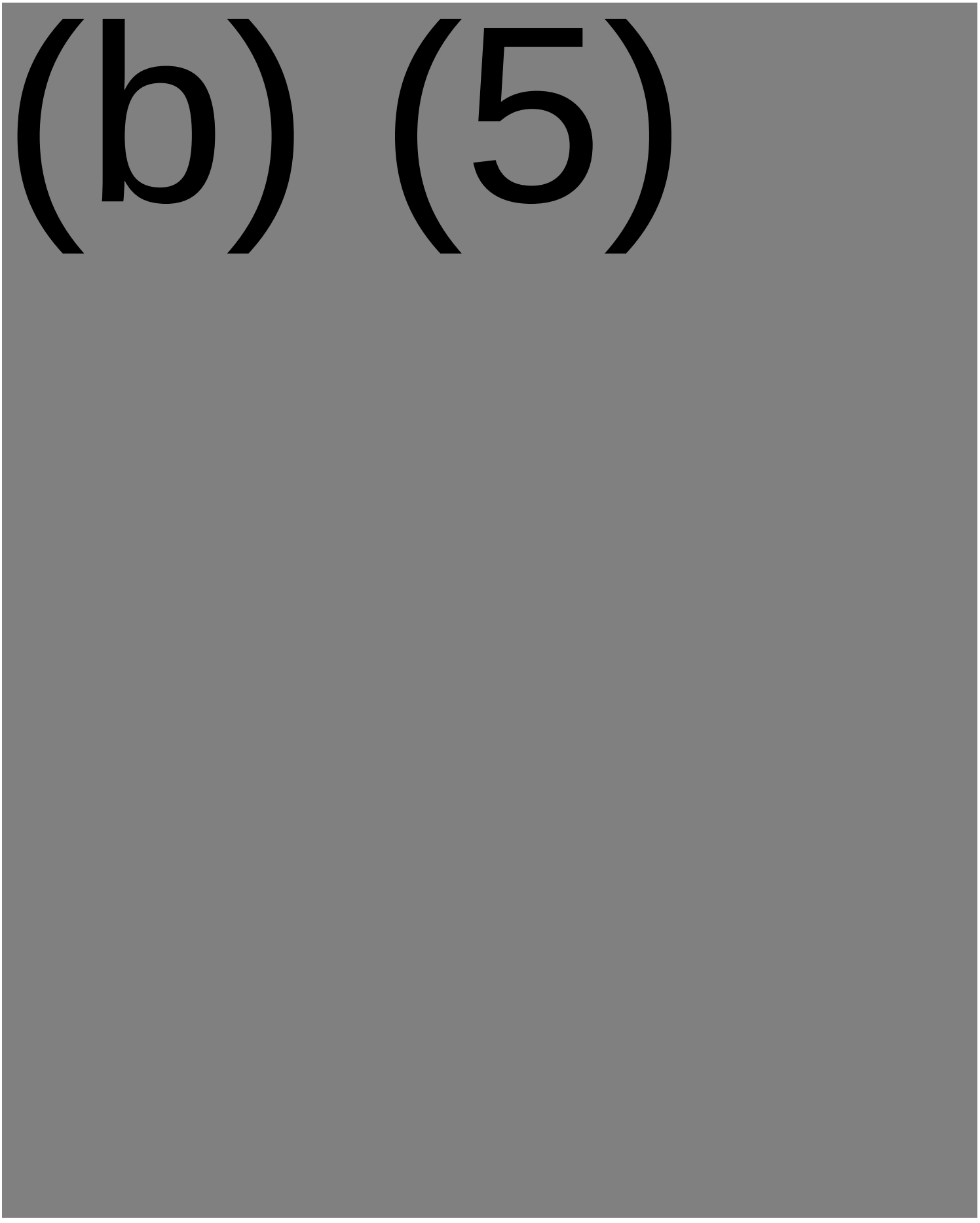
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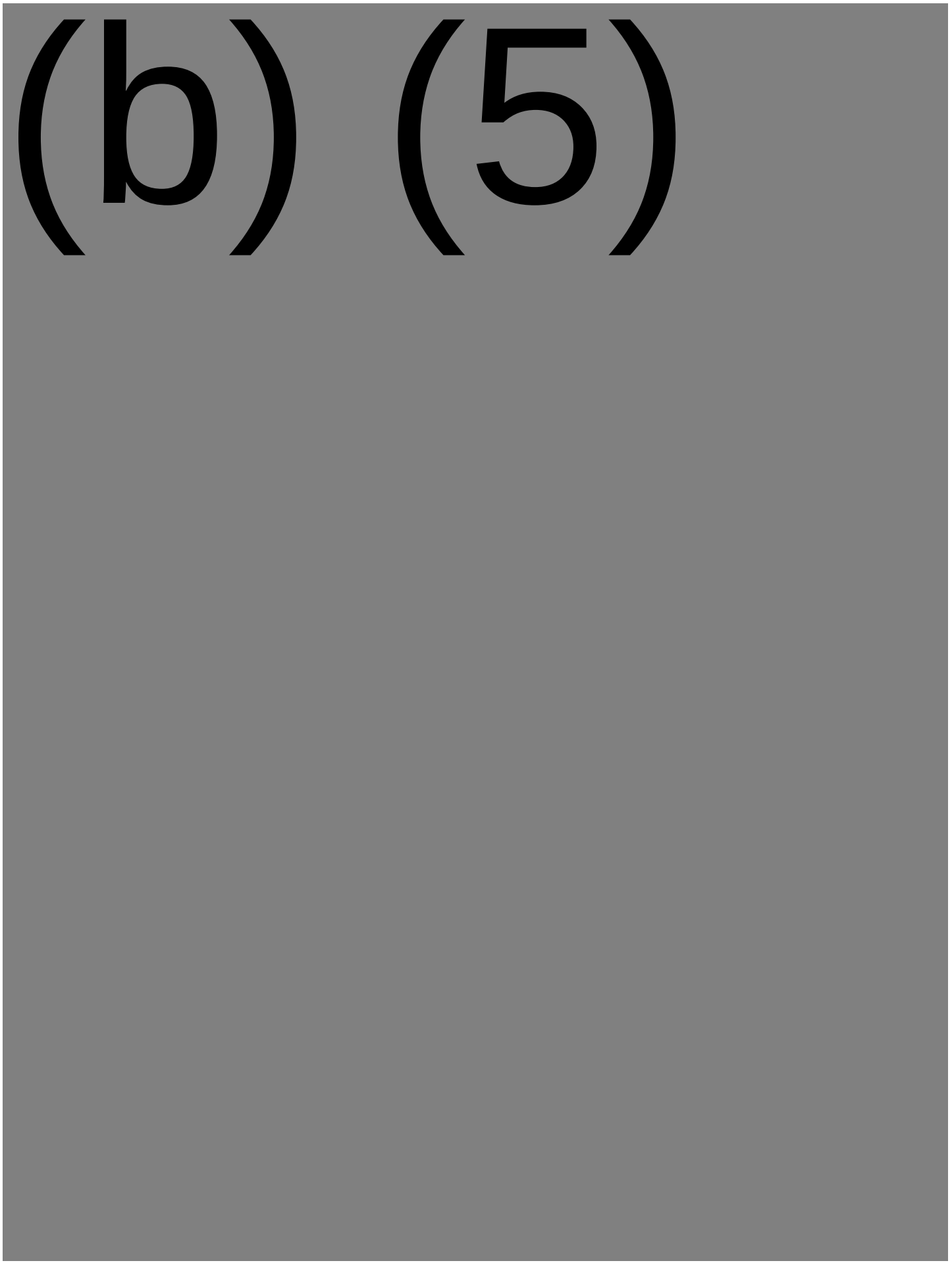
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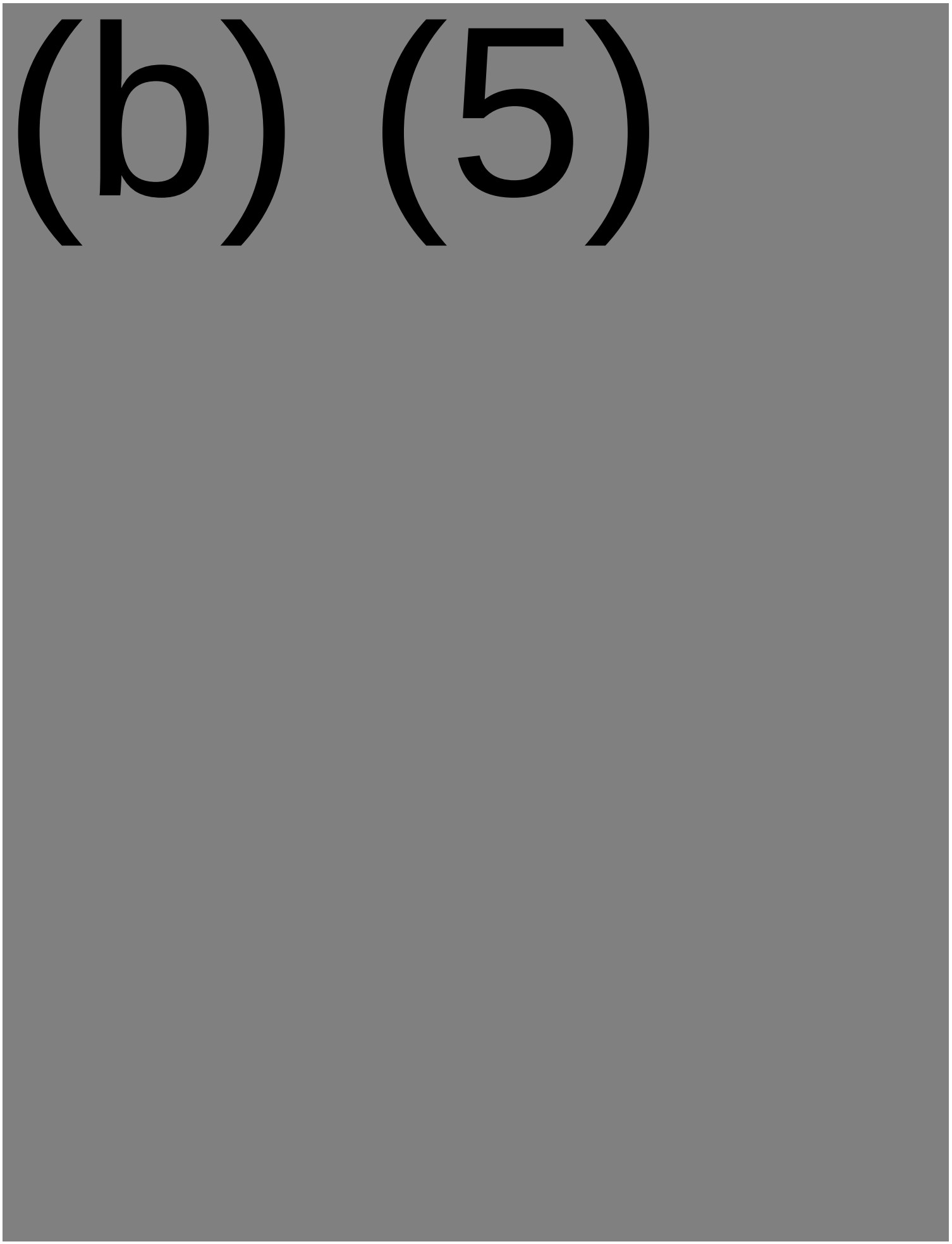
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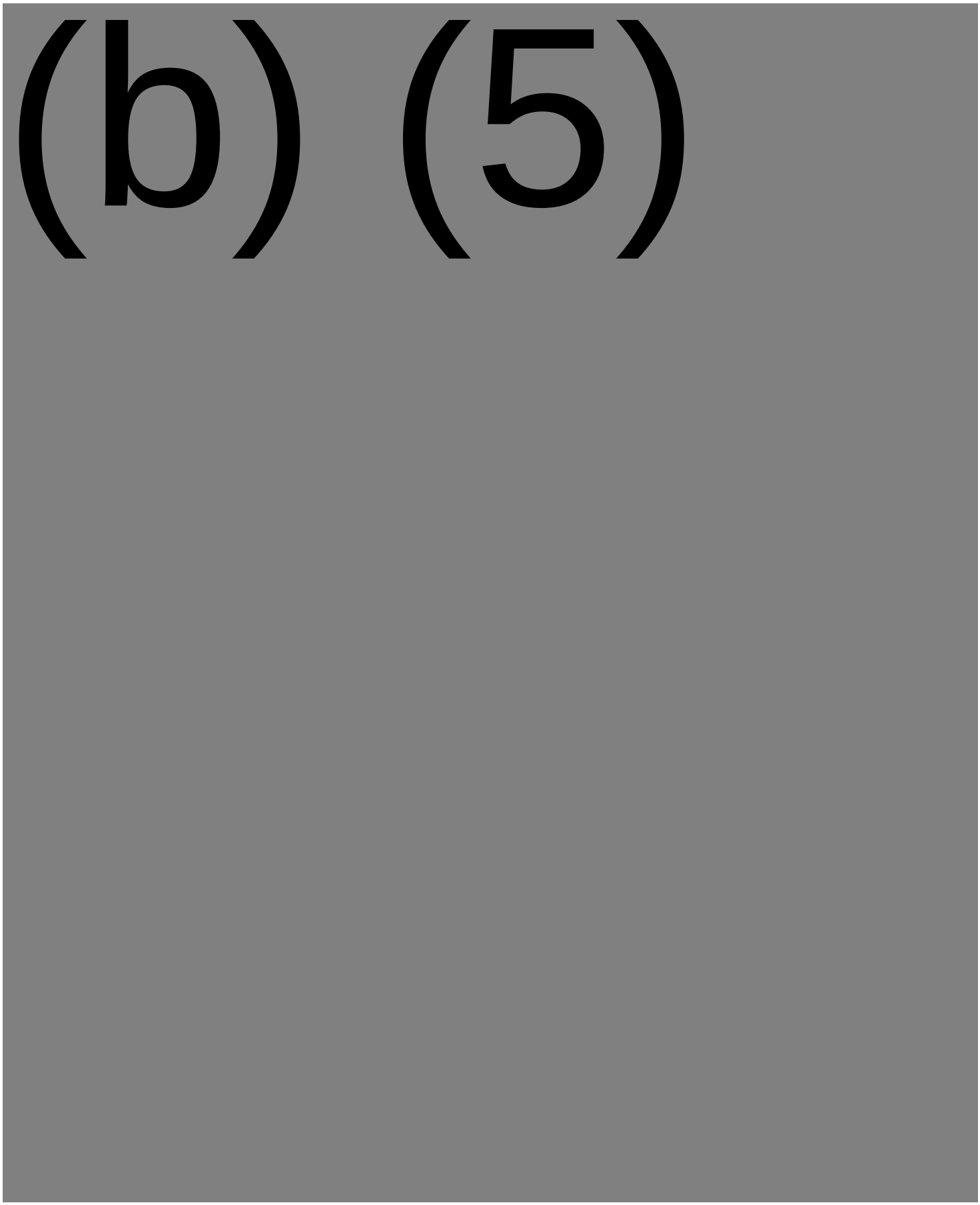
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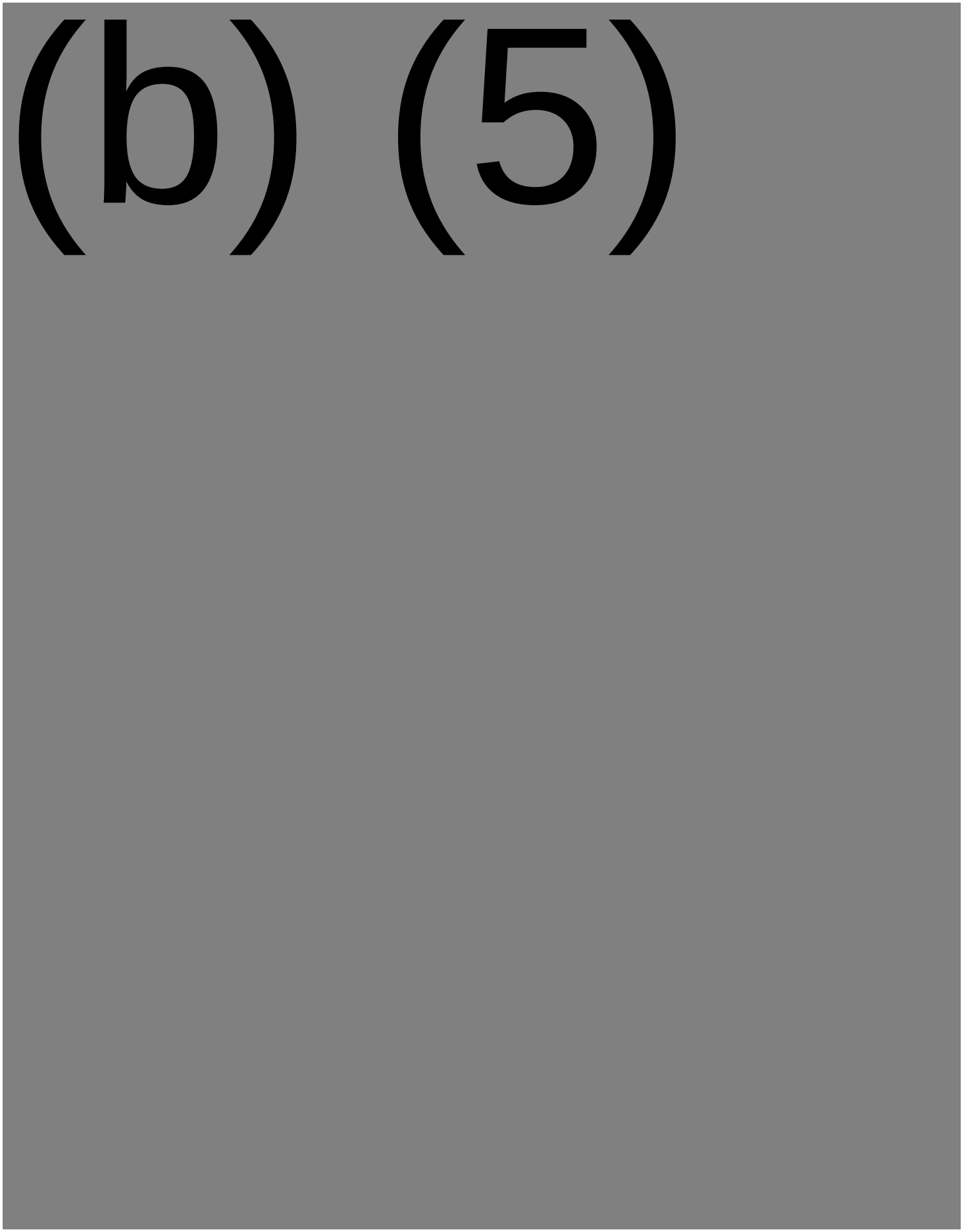
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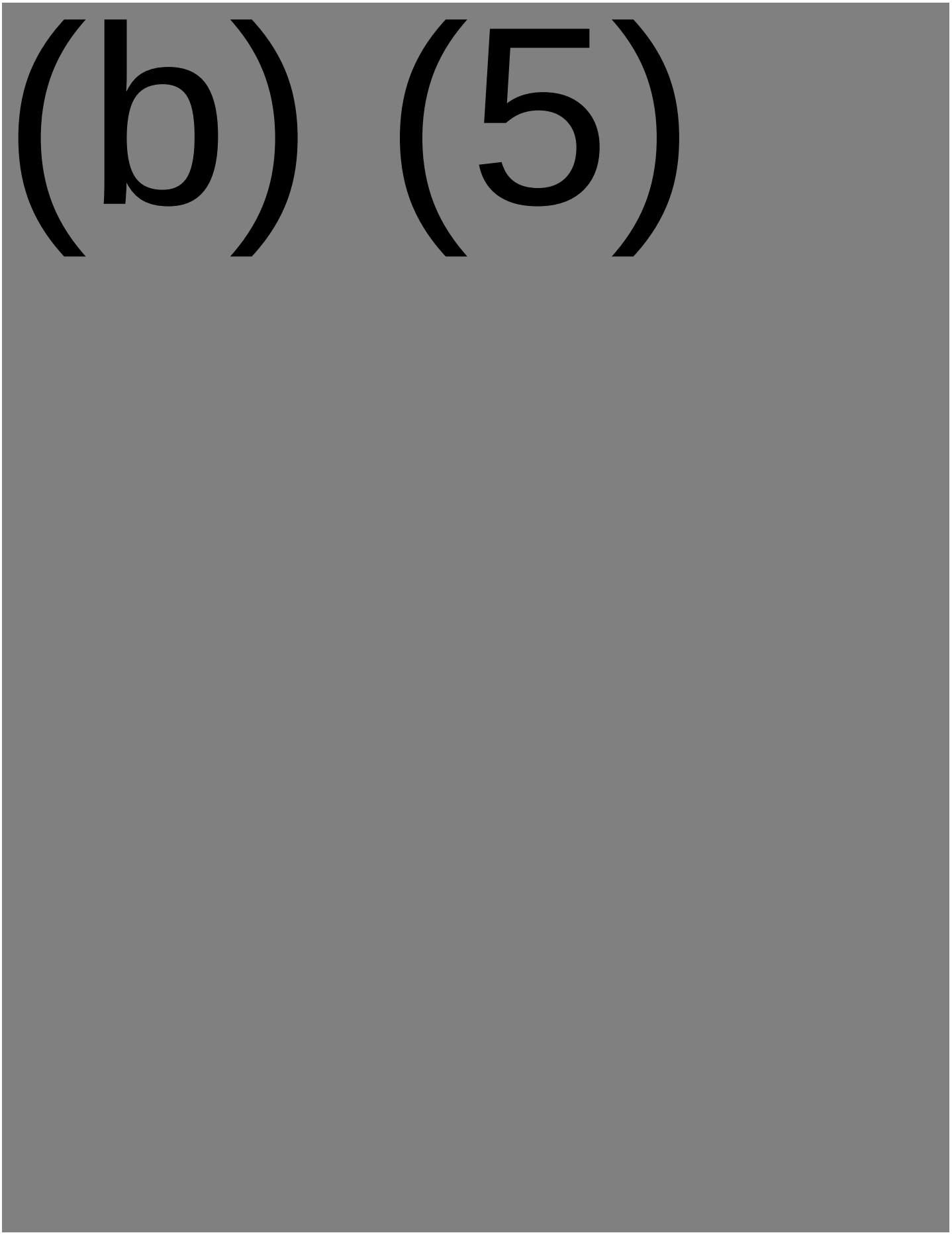
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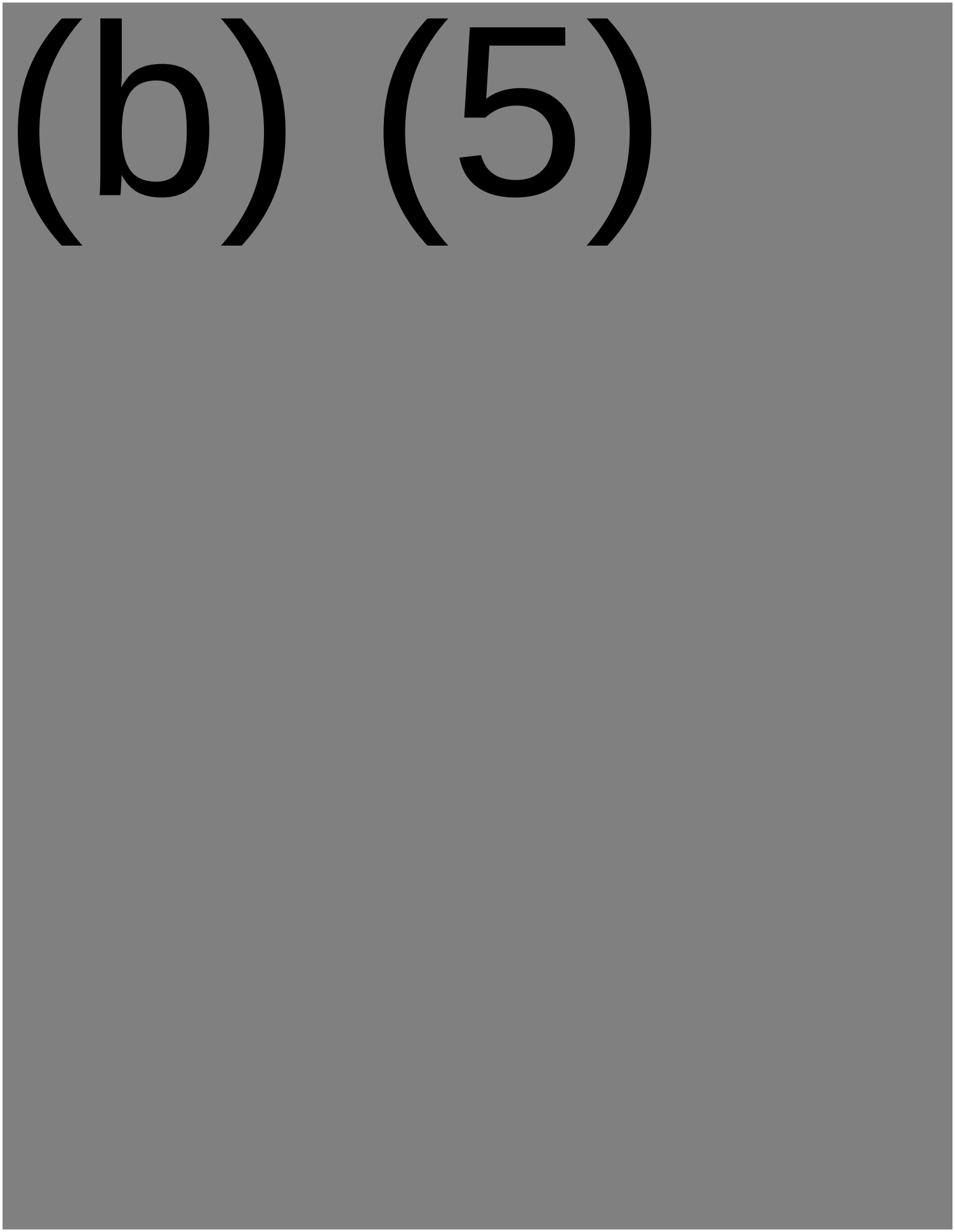
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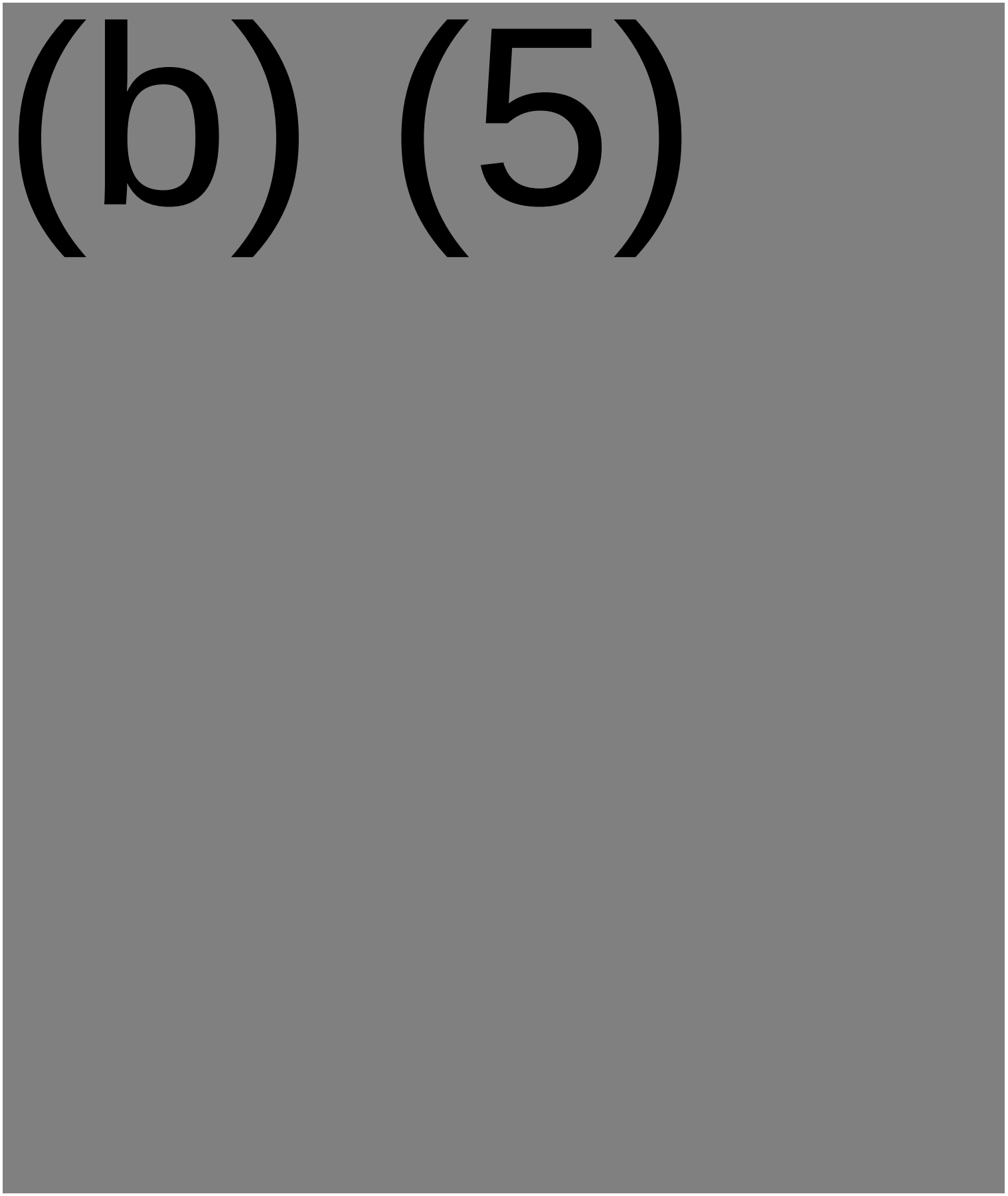
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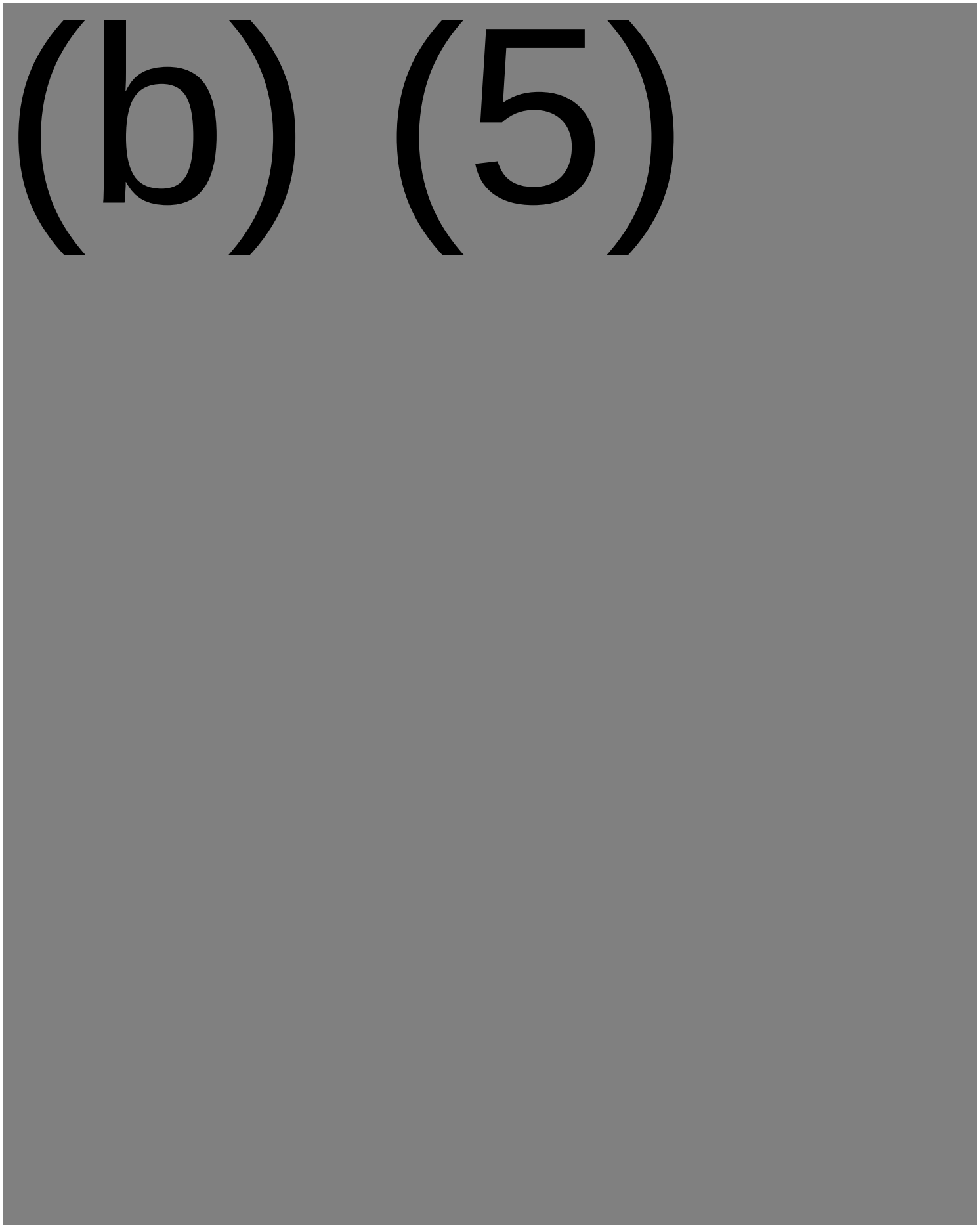
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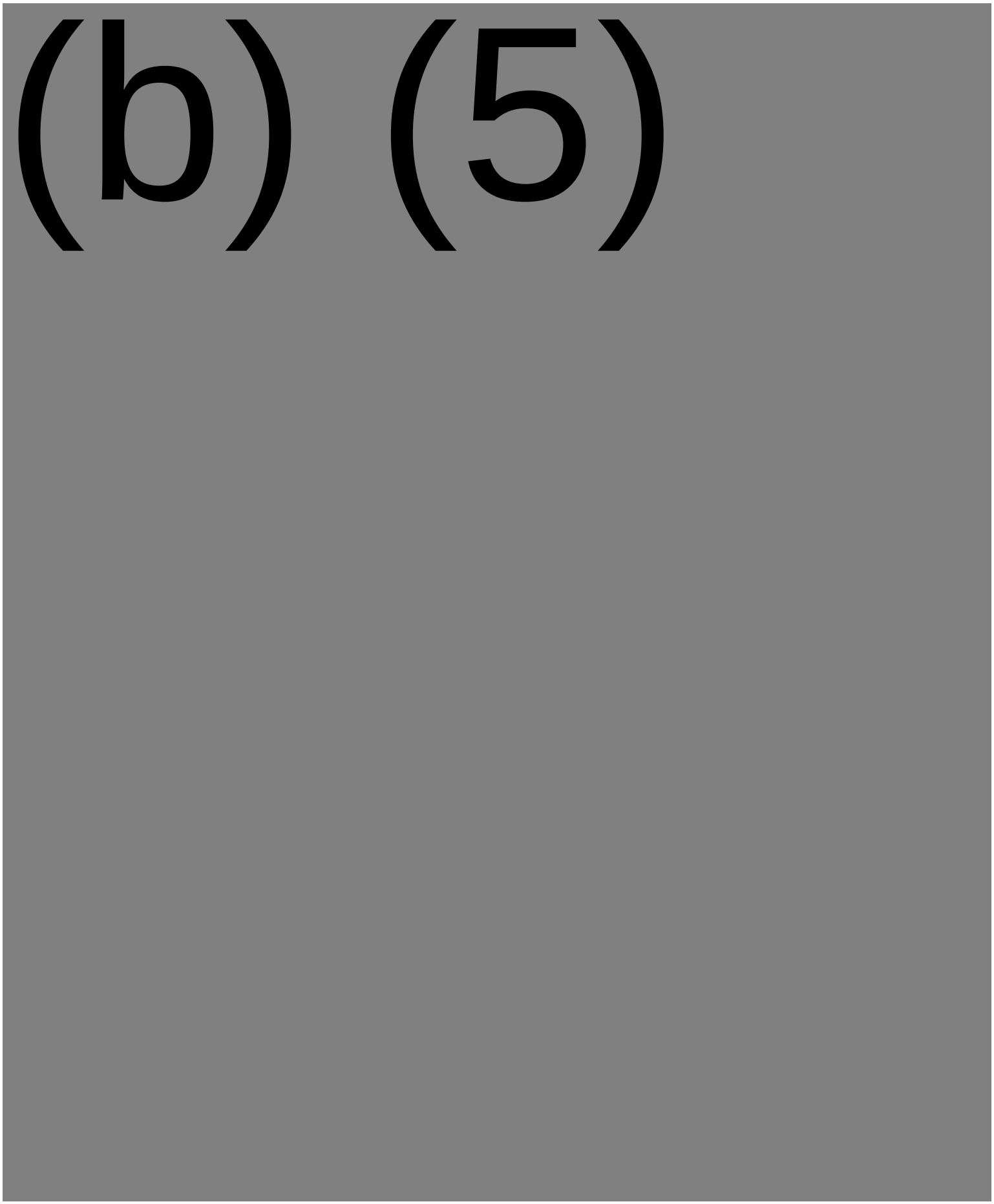
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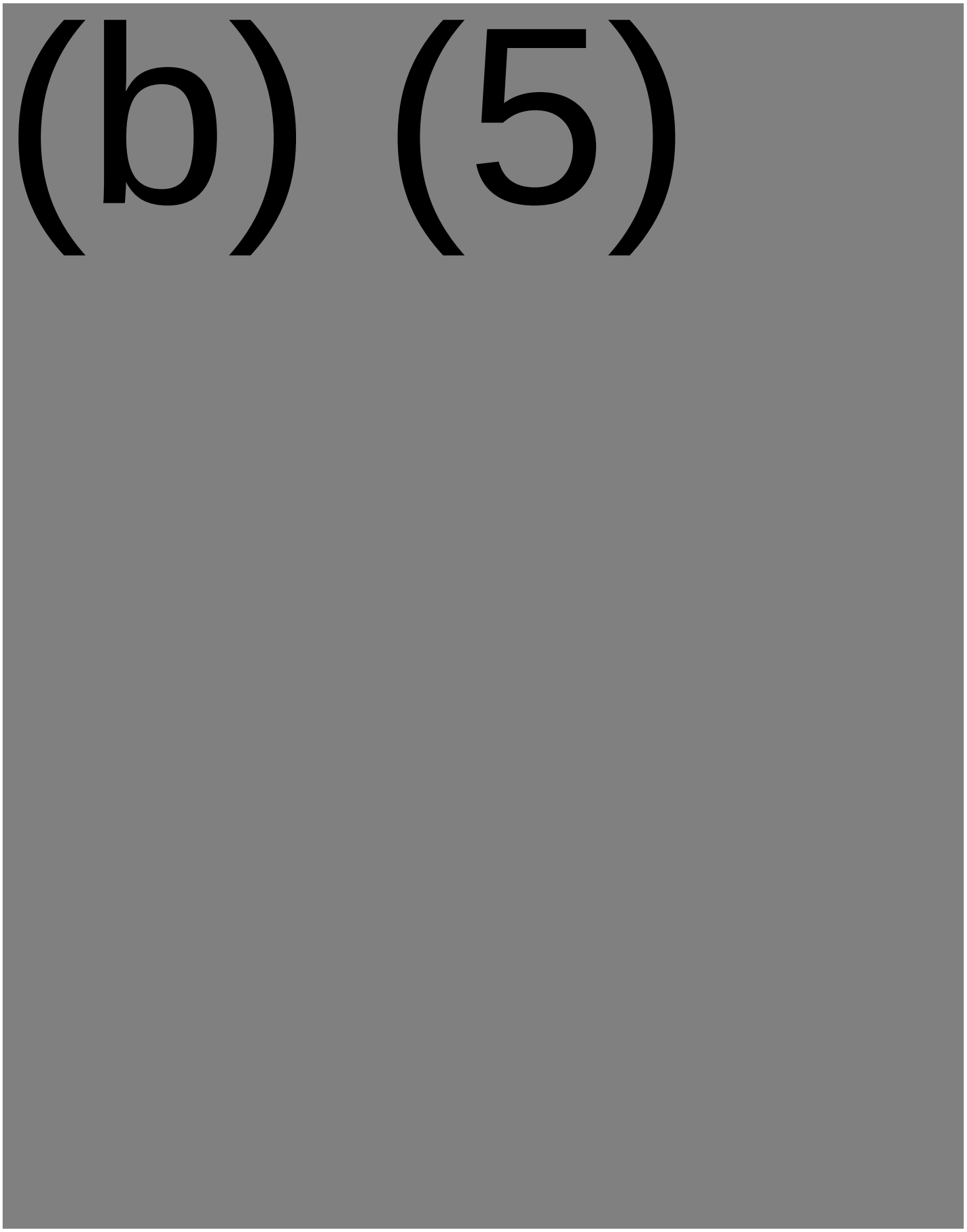
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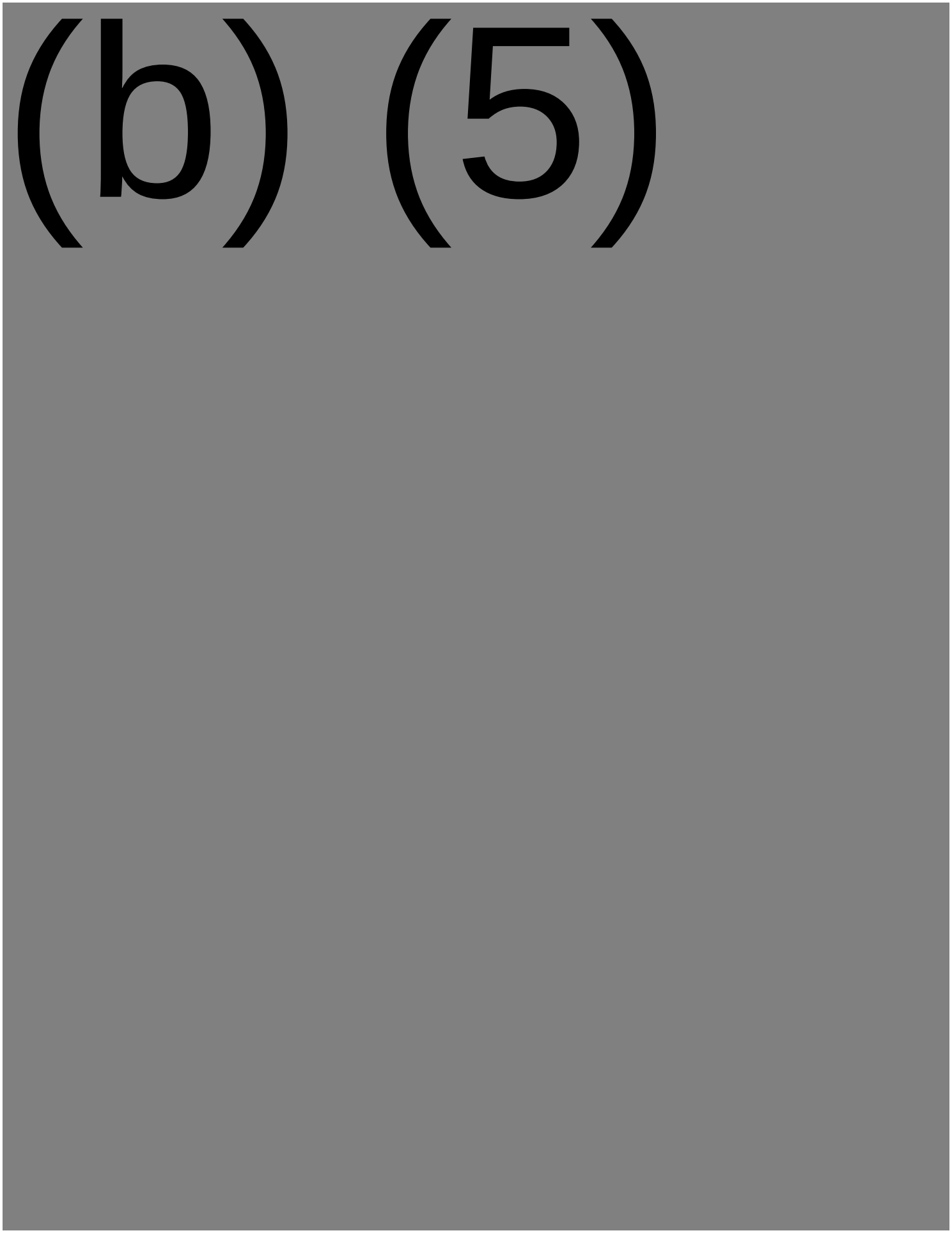
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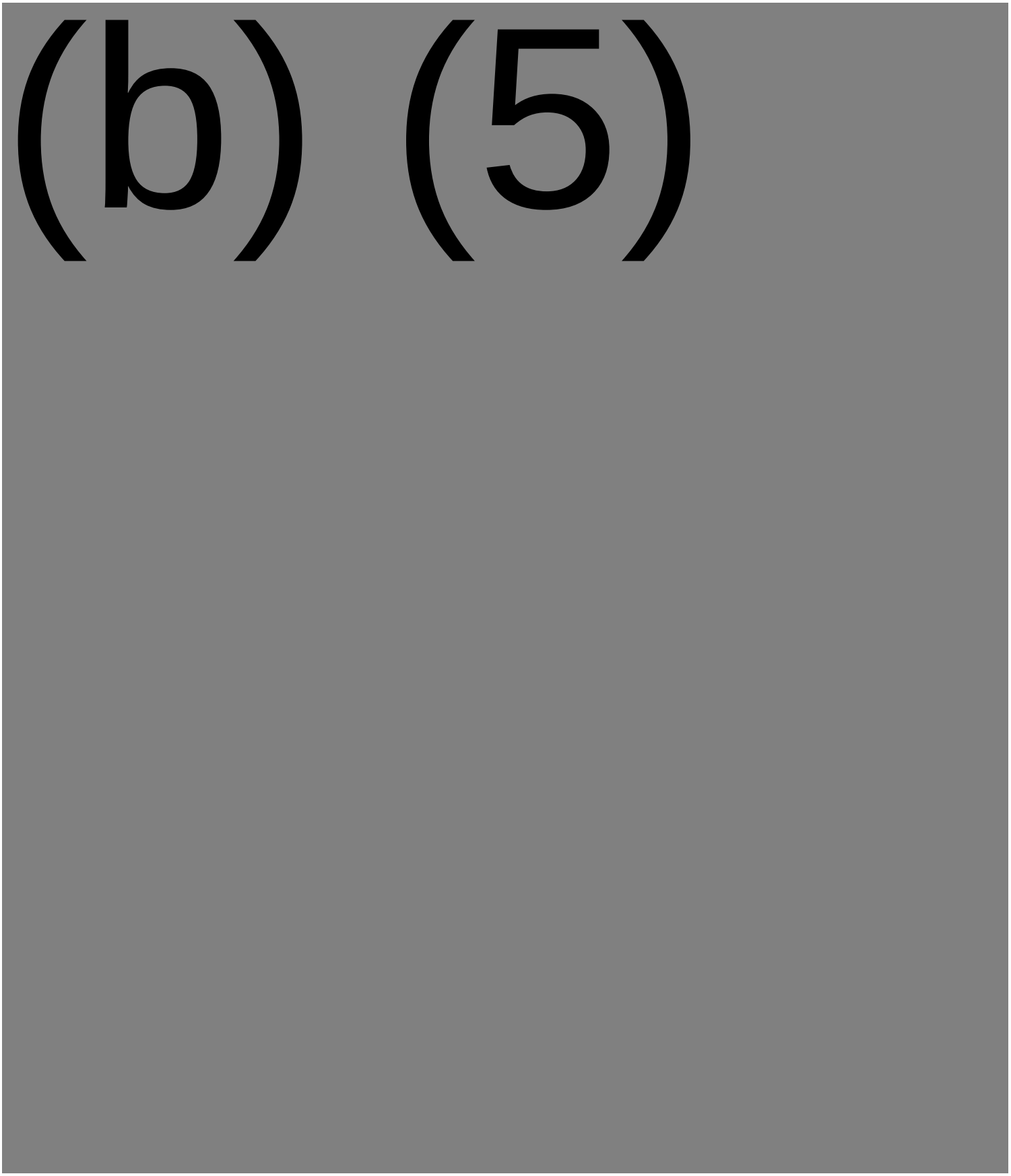
(b) (5)

[EXTERNAL] FYI..

From: David Caluori (b) (6)

To: "Lattimore, Tracie B. EOP/OSTP" (b) (6) "Waterman, Paige E. EOP/OSTP" (b) (6), Ann Hickey (b) (6) Blythe Adamson <(b) (6)

Date: Sun, 29 Mar 2020 17:11:19 -0400

Attachments: National-Coronavirus-Response-a-Road-Map-to-Recovering-1.pdf (5.89 MB)

>https://www.aei.org/wp-content/uploads/2020/03/National-Coronavirus-Response-a-Road-Map-to-Recovering-1.pdf<

David Caluori

National Coronavirus Response

A ROAD MAP TO REOPENING

Scott Gottlieb, MD

Caitlin Rivers, PhD, MPH

Mark B. McClellan, MD, PhD

Lauren Silvis, JD

Crystal Watson, DrPh, MPH

MARCH 28, 2020

AMERICAN ENTERPRISE INSTITUTE

National Coronavirus Response

A ROAD MAP TO REOPENING

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MARCH 28, 2020

AMERICAN ENTERPRISE INSTITUTE

Contents

Executive Summary

This report provides a road map for navigating through the current COVID-19 pandemic in the United States. It outlines specific directions for adapting our public-health strategy as we limit the epidemic spread of COVID-19 and are able to transition to new tools and approaches to prevent further spread of the disease. We outline the steps that can be taken as epidemic transmission is brought under control in different regions. These steps can transition to tools and approaches that target those with infection rather than mitigation tactics that target entire populations in regions where transmission is widespread and not controlled. We suggest measurable milestones for identifying when we can make these transitions and start reopening America for businesses and families.

In each phase, we outline the steps that the federal government, working with the states and public-health and health care partners, should take to inform the response. This will take time, but planning for each phase should begin now so the infrastructure is in place when it is time to transition.

The specific milestones and markers included in the report for transitioning our responses are judgments based on our current understanding, with the goal of facilitating an effective path forward. The epidemic is evolving rapidly, and our understanding of best responses will evolve as well. The broad set of tasks described here requires and will receive high-level, ongoing attention, and it should be updated and refined as additional evidence, context, and insights about the epidemic become available.

To gradually move away from a reliance on physical distancing as our primary tool for controlling future spread, we need:

1) Better data to identify areas of spread and the rate of exposure and immunity in the population;
2) Improvements in state and local health care system capabilities, public-health infrastructure for early outbreak identification, case containment, and adequate medical supplies; and
3) Therapeutic, prophylactic, and preventive treatments and better-informed medical interventions that give us the tools to protect the most vulnerable people and help rescue those who may become very sick.

Our stepwise approach depends on our ability to aggregate and analyze data in real time. To strengthen our public-health surveillance system to account for the unprecedented spread of COVID-19, we need to harness the power of technology and drive additional resources to our state and local public-health departments, which are on the front lines of case identification and contact tracing. Finally, we must expand our investments in pharmaceutical research and development into COVID-19 and promote the rapid deployment of effective diagnostics, therapies, and eventually a vaccine.

Slow the Spread in Phase 1. This is the current phase of response. The COVID-19 epidemic in the United States is growing, with community transmission occurring in every state. To slow the spread in this period,[1] schools are closed across the country, workers are being asked to do their jobs from home when possible, community gathering spaces such as malls and gyms are closed, and restaurants are being asked to limit their services. These measures will need to be in place in each state until transmission has measurably slowed down and health infrastructure can be scaled up to safely manage the outbreak and care for the sick.

1

State-by-State Reopening in Phase II. Individual states can move to Phase II when they are able to safely diagnose, treat, and isolate COVID-19 cases and their contacts. During this phase, schools and businesses can reopen, and much of normal life can begin to resume in a phased approach. However, some physical distancing measures and limitations on gatherings will still need to be in place to prevent transmission from accelerating again. For older adults (those over age 60), those with underlying health conditions, and other populations at heightened risk from COVID-19, continuing to limit time in the community will be important.

Public hygiene will be sharply improved, and deep cleanings on shared spaces should become more routine. Shared surfaces will be more frequently sanitized, among other measures. In addition to case-based interventions that more actively identify and isolate people with the disease and their contacts, the public will initially be asked to limit gatherings, and people will initially be asked to wear fabric nonmedical face masks while in the community to reduce their risk of asymptomatic spread. Those who are sick will be asked to stay home and seek testing for COVID-19. Testing should become more widespread and routine as point-of-care diagnostics are fully deployed in doctors' offices.

While we focus on state-by-state reopening of activities in a responsible manner and based on surveillance data, we note that states may move forward at a county or regional level if these conditions vary within the state and that coordination on reopening among states that share metropolitan regions will be necessary.

Establish Immune Protection and Lift Physical Distancing During Phase III. Physical distancing restrictions and other Phase II measures can be lifted when safe and effective tools for mitigating the risk of COVID-19 are available, including broad surveillance, therapeutics that can rescue patients with significant disease or prevent serious illness in those most at risk, or a safe and effective vaccine.

Rebuild Our Readiness for the Next Pandemic in Phase IV. After we successfully defeat COVID-19, we must ensure that America is never again unprepared to face a new infectious disease threat. This will require investment into research and development initiatives, expansion of public-health and health care infrastructure and workforce, and clear governance structures to execute strong preparedness plans. Properly implemented, the steps described here also provide the foundation for containing the damage that future pathogens may cause.

Phase I: Slow the Spread

Goals

The goal of Phase I is to save lives by:

1) Slowing the transmission of SARS-CoV-2 across the United States by reducing the effective reproduction number of infections,

2) Increasing testing capacity to accommodate the ability to test everyone with symptoms and their close contacts, and

3) Ensuring the health care system has the capacity to safely treat both COVID-19 patients and others requiring care.

A successful Phase I will allow for a significant relaxation of physical distancing measures and a progression to Phase II, when more targeted, case-based interventions are possible.

Stay-at-Home Advisories

The trigger for issuing a stay-at-home advisory[6] in a US state is when case counts are doubling every three to five days[7] (based on the current New York experience) or when state and local officials recommend it based on the local context (for example, growth on track to overwhelm the health system's capacity).

The trigger for issuing a recommendation to step down from a stay-at-home-advisory back to "slow the spread" is when the number of new cases reported in a state has declined steadily for 14 days (i.e., one incubation period) and the jurisdiction is able to test everyone seeking care for COVID-19 symptoms.

Thresholds for Action

Trigger to Begin to "Slow the Spread." The trigger to implement nationwide "slow the spread" measures[2] in Phase I is the existence in multiple geographic locations around the country of confirmed cases that cannot be traced back to other known cases ("community spread").[3] This trigger has already been reached in the United States.

Trigger to Move to Phase II. To guard against the risk that large outbreaks or epidemic spread could reignite once we lift our initial efforts to "slow the spread," the trigger for a move to Phase II should be when a state reports a sustained reduction in cases for at least 14 days (i.e., one incubation period); *and* local hospitals are safely able to treat all patients requiring hospitalization without resorting to crisis standards of care[4]; *and* the capacity exists in the state to test all people with COVID-19 symptoms, along with state capacity to conduct active monitoring of all confirmed cases and their contacts.[5]

Steps Required in Phase I

Maintain Physical Distancing. Each state must maintain community-level physical distancing measures[8] until the threshold for moving to Phase II is met. These Phase I measures include:

- Closing community gathering spaces such as schools, shopping centers, dining areas,

museums, and gyms statewide (places where people congregate indoors);

- Promoting telework for nonessential employees statewide;
- Urging the public to limit unnecessary domestic or international travel;
- Canceling or postponing meetings and mass gatherings;
- Shutting dining areas but encouraging restaurants to provide takeout and delivery services if possible;
- Issuing stay-at-home advisories in hot spots where transmission is particularly intense (i.e., when case counts are doubling in a city or locality every three to five days); and
- Monitoring community adherence to physical distancing and stay-at-home advisories, adjusting risk messaging as appropriate, and identifying alternative incentives for compliance if needed.

Increase Diagnostic Testing Capacity and Build Data Infrastructure for Rapid Sharing of Results. Same-day, point-of-care diagnostic testing (widely available in outpatient settings) is crucial for identifying cases, including those with asymptomatic and mild infections. To move from community-wide interventions that focus on large populations to case-based interventions that target and isolate individual people who are infected, capacity should be sufficient to test:

1) Hospitalized patients (rapid diagnostics are needed for this population);
2) Health care workers and workers in essential roles (those in community-facing roles in health and public safety);
3) Close contacts of confirmed cases; and
4) Outpatients with symptoms. (This is best accomplished with point-of-care diagnostics in doctors' offices with guidelines that encourage widespread screening and mandated coverage for testing.)

We estimate that a national capacity of at least 750,000 tests per week would be sufficient to move to case-based interventions when paired with sufficient capacity in supportive public-health infrastructure (e.g., contact tracing).[9] In conjunction with more widespread testing, we need to invest in new tools to make it efficient for providers to communicate test results and make data easily accessible to public-health officials working to contain future outbreaks.

Ensure Functioning of the Health Care System. Ensure sufficient critical-care capacity[10] in hospitals to be able to immediately expand capacity from 2.8 critical-care beds per 10,000 adults to 5–7 beds per 10,000 adults in the setting of an epidemic or other emergency, allowing for regional variation.[11] This target is a minimum, must be adequate for the current and forecasted level of demand, and must be accompanied by adequate staffing. Regional variation in capacity reflecting local needs is acceptable.

Expand access to ventilators in hospitals from 3 per 10,000 adults to a goal of 5–7 ventilators per 10,000 adults.[12] This target does not include transport or anesthesia machines. This target is a minimum, must be adequate for the current and forecasted level of demand, and must be accompanied by adequate staffing. Regional variation in capacity reflecting local needs is acceptable.

Maintain access to acute-care hospital beds of at least 30 per 10,000 adults.[13] Facilities should have a plan, in the case of a surge in hospital demand, for how the beds would be rapidly flexed from more discretionary uses (e.g., elective procedures) and adequately staffed, with access to adequate supplies of oxygen and other medical supplies.

This health care functioning target would also be met if critical-care and ventilator capacity does not expand to that level but COVID-19 incidence is maintained or falls meaningfully below the state's capacity to meet critical-care demand. These capacity targets can also be partially met through the availability of ample mobile health care infrastructures (supported and perhaps maintained by federal or state governments) that can be distributed and set up on short notice to hot areas with surge capacity needs.

Increase Supply of Personal Protective Equipment. The Centers for Disease Control and Prevention (CDC) recommends, at a minimum, N95 respirators for hospital staff expected to have direct contact with COVID-19 patients, plus disposable procedural or surgical masks for all other clinical personnel in any health care setting.[14] The supply chain should be able to reliably distribute sufficient N95 masks, gloves, and other personal protective equipment to protect health care workers from infection.

Implement Comprehensive COVID-19 Surveillance Systems. The move toward less restrictive physical distancing could precipitate another period of acceleration in case counts. Careful surveillance will be needed to monitor trends in incidence. A high-performing disease surveillance system should be established that leverages:

1) Widespread and rapid testing at the point of care using cheaper, accessible, and sensitive point-of-care diagnostic tools that are authorized by the Food and Drug Administration (FDA);

2) Serological testing to gauge background rates of exposure and immunity to inform public-health decision-making about the level of population-based mitigation required to prevent continued spread in the setting of an outbreak; and

3) A comprehensive national sentinel surveillance system, supported by and coordinated with local public-health systems and health care providers, to track the background rate of infection across states and identify community spread while an outbreak is still small and at a stage in which case-based interventions can prevent a larger outbreak.

ILINet, the surveillance system for influenza-like illness in the United States, is a potential model for SARS-CoV-2 surveillance. To enable rapid and more effective detection and case management, SARS-CoV-2 surveillance will also benefit from data sharing and coordination with health care providers and payers. The CDC should convene an intergovernmental task force, with outside experts as needed and input from states and the health care community, to develop and support a new national surveillance system and data infrastructure for tracking and analyzing COVID-19.

Massively Scale Contact Tracing and Isolation and Quarantine. When a new case of COVID-19 is diagnosed, the patient should be isolated either at home or in a hospital, depending on the level of care he or she requires. Current CDC guidelines recommend seven days of isolation.[15] Home isolation can be enforced using technology such as GPS tracking on cell phone apps. Also, the close contacts of confirmed cases (as defined by the CDC[16]) should be quarantined and monitored daily for 14 days. Monitoring of international travelers is also recommended.[17]

To scale these interventions to accommodate thousands of daily cases and tens of thousands of daily contacts, public-health infrastructure will need to be dramatically scaled up throughout the country, in coordination with the improving capacity of health care providers to prevent, diagnose, and treat COVID-19 cases.

The task force should also be charged with developing and overseeing an initiative to:

1) Surge the existing public-health workforce to conduct case finding and contact tracing;

2) Enable rapid reporting to state, local, and federal health authorities, through the public-health

workforce and electronic data sharing from health care providers and labs; and

3) Develop and field a technological approach to enable rapid data entry, reporting, and support for isolation, quarantine, and safe community-based treatment of affected individuals.

Offer Voluntary Local Isolation and Quarantine. Comfortable, free facilities should be provided for cases and their contacts who prefer local isolation, quarantine, and treatment away from home. For example, a member of a large household may wish to recover in a hotel room that has been repurposed rather than risk infecting family members. Isolation and quarantine away from home should not be mandatory or compelled by force.

The Federal Emergency Management Agency is the lead agency tasked with coordinating with state and local jurisdictions to stand up appropriate isolation and quarantine facilities. Field hospitals, dormitories, hotels, and military barracks may be appropriated for this purpose.

Encourage the Public to Wear Masks. There is emerging evidence that asymptomatic and presymptomatic transmission of COVID-19 is possible,[18] which complicates efforts to pursue case-based interventions. To reduce this risk during Phase I, everyone, including people without symptoms, should be encouraged to wear nonmedical fabric face masks while in public.[19]

Face masks will be most effective at slowing the spread of SARS-CoV-2 if they are widely used, because they may help prevent people who are asymptomatically infected from transmitting the disease unknowingly. Face masks are used widely by members of the public in some countries that have successfully managed their outbreaks, including South Korea and Hong Kong.[20] The World Health Organization (WHO) recommended members of the public use face masks in the event of a severe influenza pandemic.[21]

However, personal protective equipment should continue to be reserved for health care workers until supplies are sufficient for them and abundant. For this reason, right now members of the general public should opt to wear nonmedical fabric face masks when going out in public. The CDC should issue guidelines on the proper design of such nonmedical fabric face masks. Consumers may be able to fashion these masks themselves using available washable materials, or they may become available in the consumer marketplace.

Trigger for Moving to Phase II

A state can safely proceed to Phase II when it has achieved all the following:

- A sustained reduction in cases for at least 14 days,
- Hospitals in the state are safely able to treat all patients requiring hospitalization without resorting to crisis standards of care,[22]
- The state is able to test all people with COVID-19 symptoms, *and*
- The state is able to conduct active monitoring of confirmed cases and their contacts.[23]

Phase II: Reopen, State by State

In Phase II, the majority of schools, universities, and businesses can reopen. Teleworking should continue where convenient; social gatherings should continue to be limited to fewer than 50 people wherever possible. Other local restrictions should be considered, such as those that limit people from congregating in close proximity.

High-contact settings such as schools should continue to review and implement physical distancing measures with guidance from the CDC and input from local officials. Health officials should recommend increased social hygiene measures and cleaning of shared surfaces.

For older adults (those over 60 years old), those with underlying health conditions, and other populations at heightened risk from COVID-19, it should still be recommended that they limit time in the community during Phase II. This recommendation may change if an effective therapeutic becomes available.

We need to consider these activities on a coordinated, regional basis through multistate cooperation. While state and local governments maintain sovereignty over issues related to their public-health response, coordination based on regions that cross state boundaries will be crucial. Large states with multiple urban areas and rural regions may implement reopening at a regional level. States that share major metropolitan areas (for example, New York, New Jersey, and Connecticut) should assure that the conditions for reopening these areas are met across the relevant state boundaries.

Goals

The goals of Phase II are to:

1) Lift strict physical distancing measures in a concerted and careful fashion,

2) Allow the vast majority of businesses and schools to open, and

3) Continue to control SARS-CoV-2 transmission so we do not revert back to Phase I.

The adoption of these Phase II measures will require a careful balance. We will need to constantly reevaluate the implementation of these measures based on available surveillance data, and we will need to be ready to adjust our approach over time according to the epidemiology of local, national, and global spread. This is especially true as we transition from one phase to the next.

Thresholds for Action

Trigger to Lift Physical Distancing Measures. Once the criteria for the transition from Phase I to Phase II have been met and we begin to move away from the "slow the spread" period, leaders at the state level should begin an incremental easing of physical distancing measures. This should be done gradually and should be paired with increased surveillance for new cases. State officials should make decisions about the selection and timing of restrictions to lift based on their local contexts. Restrictions should be eased gradually, with sufficient time between each adjustment to carefully monitor for resurgence of transmission.

Trigger for Returning to Phase I, "Slow the Spread." As physical distancing is gradually eased, surveillance will be essential for quickly identifying an increase in cases in the state. A state should revert to Phase I and continue "slow the spread" if a substantial number of cases cannot be traced back to known cases, if there is a sustained rise in new cases for five

days, or if hospitals in the state are no longer able to safely treat all patients requiring hospitalization.

Trigger for Moving to Phase III. Once a vaccine has been developed, has been tested for safety and efficacy, and receives FDA emergency use authorization,[24] or there are other therapeutic options that can be used for preventive or treatment indications and that have a measurable impact on disease activity and can help rescue very sick patients, states can move to Phase III.

Steps Required in Phase II

Implement Case-Based Interventions. Using the public-health capacities developed in Phase I, every confirmed case should be isolated either at home, in a hospital, or (voluntarily) in a local isolation facility for at least seven days, or according to the latest CDC guidance. People awaiting test results should be advised to quarantine until their results are returned.

The close contacts of confirmed cases should be traced and placed under home or central quarantine, with active daily monitoring for at least 14 days, or according to the latest CDC guidance. Diagnostic tests should be immediately administered to any close contacts who develop symptoms.

Begin to Relax Physical Distancing Measures. General physical distancing precautions should still be the norm during Phase II, including teleworking (as much as possible), maintaining hand hygiene and respiratory etiquette, wearing a mask in public, regularly disinfecting high-touch surfaces, and initially limiting social gatherings to fewer than 50 people. These recommendations should be augmented through technological solutions to understand physical distancing behaviors and adjust risk messaging as needed. This should be accomplished through partnerships with the private sector, with careful attention paid to preserving privacy and avoiding coercive means to encourage compliance.

As children return to school and daycare (i.e., high-contact settings) and people return to high-density workplaces, leaders of these organizations should continue to review and implement physical distancing measures based on guidance from the CDC for schools and businesses.[25]

Special Care for Vulnerable Populations. While easing of physical distancing is taking place, highly vulnerable populations,[26] such as individuals older than age 60 and those with compromised immune systems or compromised lung and heart function, should continue to engage in physical distancing as much as possible until a vaccine is available, an effective treatment is available, or there is no longer community transmission. Special attention should be paid to long-term-care facilities and nursing homes.[27] These facilities will need to maintain high levels of infection prevention and control efforts and limit visitors to prevent outbreaks.

If a treatment or prophylactic, such as a monoclonal antibody,[28] becomes available, high-risk and vulnerable populations should be prioritized to receive it, to both protect those individuals and reduce the likelihood of an increase in severe illnesses and additional patient surge in hospital intensive care units (ICUs).

Accelerate the Development of Therapeutics. Therapeutics play an important role in caring for those who are sick. Accelerating the research, development, production, and distribution of safe and effective therapeutics is a top priority. With effective development strategies and early investments in commercial-scale manufacturing, a successful therapeutic could receive emergency use authorization or approval as early as the summer or fall, if trials demonstrate that it meets either standard.

Therapeutics can serve a number of roles. First, they can serve as a prophylaxis to help prevent infection in those at greatest risk of infection, such as front-line health care workers, or those at risk of bad outcomes, such as individuals with preexisting health conditions and those who are immunocompromised. Such a treatment could include a recombinant

antibody that can target the virus surface antigens. As an example, researchers successfully developed such a therapeutic against Ebola. These antibody drugs can also be used to treat early infection or as a postexposure prophylaxis.

Other therapeutics might include antiviral drugs that target features of how the virus replicates. These drugs can be used to treat people who are critically ill or earlier in the course of disease for those at risk of developing a complication. Antiviral drugs can also be used as postexposure prophylaxis, depending on their safety profile. Postexposure prophylaxis and products that shorten the duration and intensity of viral shedding may affect the effective reproduction number only modestly. In addition, immune-modulating treatments may prove to be helpful in mitigating severe lung complications in some patients. A number of promising drugs are in early and mid-stage development.

At a minimum, the optimal profile for a therapeutic that will affect the risk from future spread is one that meaningfully reduces the risk of death or severe disease and perhaps prevents the onset of symptoms or progression to severe disease in those exposed. Oral administration at the outpatient level would be ideal, but alternative administration requirements (e.g., infusion and jet injections) could also be scaled, with sufficient planning.

While private industry has already organized a large task force to share information and capabilities to rapidly advance promising therapies, we need a commensurate focus by federal agencies to make sure the best possible resources are brought to this mission. Federal agencies should join organized efforts already underway in the private sector.

Identify Those Who Are Immune. Serology is a method used to identify evidence of immunity in someone who has recovered from infection. With accurate and widely available serological testing, we can identify people who are immune and therefore no longer vulnerable to infection. While we need to better understand the strength of the immune response in mild cases and how long people remain immune from reinfection, we know there is a period where most people will have sufficient antibodies to offer protection. People who are immune could:

1) Return to work,

2) Serve in high-risk roles such as those at the front lines of the health care system, and

3) Serve in roles that support community functioning for people who are still physically distancing (e.g., the elderly who continue to quarantine at home).

To use serology in this way, serological assays are needed and should be widely available, accurate, rapid, and low cost. Such assays have already been developed by researchers, but they have not yet been fully validated and are not available at scale.

A task force comprised of senior leaders from the CDC, the Biomedical Advanced Research and Development Authority, the National Institute of Allergy and Infectious Diseases, the Department of Defense (DOD), the FDA, academia, and key private-sector groups (e.g., serological manufacturing companies) should be tasked to oversee the development, production, distribution, data collection, serological survey designs, and analytics for use of serology at scale.[29]

Trigger for Moving to Phase III

Once a vaccine has been developed, has been tested for safety and efficacy, and receives FDA emergency use authorization,[30] states can move to Phase III.

Phase III: Establish Protection Then Lift All Restrictions

Once a robust surveillance sentinel system is in place, coupled with widespread point-of-care testing and a robust ability to implement tracing, isolation, and quarantines—and this is supported by the availability of therapeutics that can help mitigate the risk of spread or reduce serious outcomes in those with infections—or alternatively a vaccine has been developed and tested for safety and efficacy, we can enter Phase III. The availability of these technologies (and eventually a safe and effective vaccine) will have economic and social benefits, in addition to health benefits.

Goals

The goals of safe and effective technologies for controlling transmission are to:

1) Prevent infection;

2) Treat those with early disease to prevent bad outcomes;

3) Provide a prophylaxis for those exposed to infection to prevent them from developing disease or reduce its severity;

4) In the case of a vaccine, build population-level immunity to the virus in order to reduce illness and death and stop or greatly slow spread; and

5) Enable the lifting of all physical distancing measures.

Thresholds for Action

Trigger to Begin Manufacturing Scale-Up and Vaccine or Therapeutic Prioritization Planning. As soon as a vaccine or therapeutic looks promising in pivotal clinical trials (i.e., it has been shown to be safe and looks like it will also be effective),[31] the US government should work with industry to begin planning for mass manufacturing, distribution, and administration. New provisions enacted under the recently passed Coronavirus Aid, Relief, and Economic Security Act allow for large-scale manufacturing of promising therapies, in advance of approval, to help make sure there will be adequate supply available for mass distribution, should a product demonstrate that it is safe and effective and win regulatory approval.

Trigger for Switch Toward Mass Vaccination. Once availability of a vaccine or therapeutic is able to meet demand, vaccination can expand beyond priority groups. The CDC, state public-health agencies, and vaccine developers should work together to plan for and execute mass vaccination of large populations in the US. This planning can begin before Phase III because preparation can be made regardless of vaccine availability.

Steps to Take in Phase III

Vaccine or Therapeutic Production. Once a safe and effective vaccine or therapeutic has been licensed, it will need to be quickly manufactured at scale. The Public Health Emergency Medical Countermeasures enterprise,[32] in coordination with pharmaceutical

companies and other private-sector stakeholders, should continue to plan for and implement mass production capable of quickly meeting US demand.

Vaccine or Therapeutic Prioritization—When Supply Is Still Limited. The CDC, the National Institutes of Health, the Office of the Assistant Secretary for Preparedness and Response, the DOD, and other stakeholders should revise prior influenza vaccine prioritization guidance to apply specifically to COVID-19.[33] The new prioritization guidance for the COVID-19 vaccine should identify priority groups for targeted distribution when a safe and effective vaccine starts to become available. The guidance should be transparent and explain the reasoning for priorities, including the populations in which the vaccine was studied, and should be a phased approach that expands to additional priority groups as vaccine availability expands. The guidance should be reflected in COVID-19 payment policies implemented by the Centers for Medicare & Medicaid Services (CMS) and private insurers, with treatment available at no cost to individuals who meet the priority guidance and a mechanism for reimbursement for individuals who are uninsured.

Mass Vaccination or Therapeutic Distribution—When Supply Is Abundant. The CDC should work with state and local health officials, health care providers, CMS and health insurers, and other public-health stakeholders to create a national plan for how mass vaccination will be carried out across the country. This plan should identify who will administer vaccinations, where vaccines will be offered, and how data will be collected on vaccination rates, as well as possible adverse events from the vaccine. Indemnification of vaccine developers and manufacturers should also be considered. Congress could enact legislation to support a process for compensation of any individual who has an adverse event from the vaccine, which requires medical care.

Global Vaccine Scale-Up and Vaccination. The CDC, the US Agency for International Development, the State Department, and other US stakeholders should continue to work with WHO and other international organizations and national leaders to plan for how the US will assist other countries (particularly low- and middle-income countries) with obtaining vaccine and implementing mass vaccination. Support from the United States and higher-income nations will be critical for controlling the virus globally and saving lives around the world, as well as reducing the impact that future waves of the pandemic may have on the US population.

Serological Surveys to Determine Population Immunity. One key input for understanding the population at risk is the fraction of the population who have recovered and are protected against reinfection. If a sufficiently high fraction of the population has become immune either through natural recovery or vaccination, remaining restrictions can be lifted. The CDC should be the lead agency for coordinating ongoing serological surveys.

Phase IV: Rebuild Our Readiness for the Next Pandemic

The COVID-19 pandemic has exposed serious gaps in our nation's pandemic preparedness. COVID-19 will not be the last public-health emergency to threaten American society. We must invest in the scientific, public-health, and medical infrastructure needed to prevent, detect, and respond to the next infectious disease threat.

Develop Vaccines for Novel Viruses in Months, Not Years. In response to COVID-19 and in preparation for the next previously unidentified health threat ("Disease X"[34]), the United States should lead the way by setting an ambitious goal of rapidly developing medical countermeasures for novel or unknown threats in months, not years. A dedicated strategy, program, and funding will be needed to create the ability at existing agencies within the US Department of Health and Human Services and DOD to quickly develop flexible platforms and countermeasures for any type of novel pathogen.[35] This strategy should include supporting flexible manufacturing capacity to scale up production to a global level in an emergency.

Modernize and Fortify the Health Care System. We must improve our hospital-bed and ICU capacity to accommodate large surges of patients through public-private partnerships, for example, by enhancing the Hospital Preparedness Program[36] and the Public Health Emergency Preparedness Cooperative Agreement[37] and emphasizing preparedness in federal health care programs (e.g., the CMS[38] and the Department of Veterans Affairs[39]). We must also expand the supply chain of personal protective equipment and further the development of crisis standards of care. To reduce future burdens on our critical-care systems, we must also support our primary and community care capabilities to identify populations at elevated risk, detect cases early, and manage them at home or in the community more effectively. Health care payers have been implementing payment reforms to support better screening and population health management. Emergency supplemental payments to health care providers in the current pandemic and future health care payments should be linked to establishing better surge capacity for severe cases and stronger capabilities to partner with public-health authorities to contain outbreaks and reduce the burden on hospitals.

Establish a National Infectious Disease Forecasting Center. Given the important role of infectious disease modeling in supporting public-health decision-making, we should increase our nation's capacity to use infectious disease modeling[40] to support public-health decision-making by establishing a national infectious disease forecasting center. This permanent federal institution would function similarly to the National Weather Service, providing a centralized capability for both producing models and undertaking investigations to improve methods used to advance basic science, data science, and visualization capabilities. It would also provide decision support to public-health agencies based on modeling and analytic results.

Governance. We need to move away from a decentralized system that promotes unequal implementation of preparedness measures across the nation and toward a more coordinated execution of response. We should develop clear and effective plans for the implementation of public-health measures such as quarantine and the unification of actions made by state and local health departments. Outbreaks are matters of regional—and more typically national—concern. Preparedness for public-health emergencies should be elevated as a function in the White House, with a coordinating function analogous to the director of national intelligence.

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Re: [EXTERNAL] Fwd: FINAL VERSION WITH CORRECT VIDEO LINK

From: Charlene Babcock (b) (6)

To: "Waterman, Paige E. EOP/OSTP" (b) (6)

Cc: "Boehler, Adam" (b) (6), Rene Franco Elizondo (b) (6), Lorenzo Paladino (b) (6), "Bunting, Leonard" (b) (6), (b) (6), Nader Habashi (b) (6)

Date: Tue, 31 Mar 2020 12:22:14 -0400

Attachments: CoVenting Protocol for HHS Correct video link.docx (8.38 MB)

Hi Paige,
THis draft is the final draft...approved by all....previous draft (currently published) has NOT been approved by any of us.

Please publish corrected version....

THanks again for all your help in getting this corrected....

CHarlene

On Tue, Mar 31, 2020 at 12:05 PM Waterman, Paige E. EOP/OSTP <(b) (6) wrote:

> Charlene – not sure it is in time and cannot accept versions that have not been approved by Nader and Lewis.
>
> **From:** Charlene Babcock (b) (6)
> **Sent:** Tuesday, March 31, 2020 11:31 AM
> **To:** Waterman, Paige E. EOP/OSTP (b) (6) Boehler, Adam (b) (6) Rene Franco Elizondo (b) (6) Lorenzo Paladino (b) (6) Bunting, Leonard (b) (6); (b) (6); Nader Habashi (b) (6)
> **Subject:** [EXTERNAL] Fwd: FINAL VERSION WITH CORRECT VIDEO LINK
>
> Paige,

I sent this to Mia...she (hopefully) is getting it formatted to replace the one released (the released one doesn't have the correct video link, is missing the edits to make it clearer, and doesn't have correct author names). I called her and she said they will 'format' it and try and get it replaced in a few hours...can you help make sure we release the correct version?

We have already gotten comments about the poor quality of the currently released document (wrong names, non-working link, etc.)

Charlene

---------- Forwarded message ---------
From: **Charlene Babcock** (b) (6)
Date: Tue, Mar 31, 2020 at 11:18 AM
Subject: Fwd: FINAL VERSION WITH CORRECT VIDEO LINK
To: Heck, Mia (HHS/OASH) (b) (6)

---------- Forwarded message ---------
From: **Charlene Babcock** <(b) (6)
Date: Tue, Mar 31, 2020 at 9:10 AM
Subject: FINAL VERSION WITH CORRECT VIDEO LINK
To: Boehler, Adam (b) (6), Waterman, Paige E. EOP/OSTP
(b) (6) >, Bunting, Leonard (b) (6), Lorenzo Paladino
<(b) (6) Nader Habashi
<(b) (6) Charlene Irvin (b) (6), Rene Franco Elizondo
(b) (6)

Dr. Waterman,

Please accept our apology for any confusion. We worked late into the night, and some of us were working clinically overnight....so we edited the paper and this version is the edited version with the correct (now public) video link.

Co-Ventilating Patients During a Critical Ventilator Shortage: A Method for Implementation

From the Washington DC COVID-19 Co-Ventilation Task force
Charlene Irvin Babcock MD
Rene Franco MD
Leonard Bunting MD
Lorenzo Paladino MD
Nader M. Habashi MD
Lewis J. Kaplan MD
Penny Andrews RN BSN
Maria Madden MS RRT
Sandra A. Shortt BS RRT

Introduction

In the COVID-19 (SARS CoV-2) Pandemic, many hospitals may be confronted with the inability to provide adequate numbers of ventilators to serve all patients requiring invasive ventilation. Using one ventilator for a single patient is the only established method to safely and reliably provide mechanical ventilation for patients with acute respiratory failure. The use of 1 ventilator to support 2 patients simultaneously (Co-Venting) is technically possible and has been tested only in controlled, experimental models using test lungs or animals for brief periods. The reliability and safety of Co-Venting in critically ill patients remains unknown. Identifying and managing the complexities of critically ill patients are among the most challenging and unpredictable aspects of Co-Venting. Therefore, the use of Co-Venting should only be considered if a hospital cannot provide clinically proven, reliable, and safe methods to manage acute respiratory failure, including manual bagging. Co-Venting should be performed for the briefest time required with rapid transition to 1:1 patient-ventilator support when additional ventilators become available.

This document provides one technical method of applying Co-Venting, necessary precautions, ***guidance*** for patient selection and clinical management, ventilator circuit assembly, patient grouping criteria, potential ventilator adjustments, and limitations during Co-Venting.

General Considerations

Every possible effort has been made to minimize safety risks. Specifically, a technique to measure tidal volumes and plateau pressures in each patient has been described and recommended as part of the routine monitoring of these patients. A proposed workflow with different Groups will allow clinicians to optimize individualization of PEEP and FiO2 requirements for each patient group. Certainly, incorporation of automated alarms and immediate feedback/monitoring of volumes and pressures is an area where further technologic development would be of great benefit in augmenting the safety of co-ventilation during crisis conditions. Finally, in the event where a patient needs to be emergently disconnected from a coventilation circuit (i.e. Cardiac arrest /CPR), a procedure is described to minimize the compromise of the other co-ventilated patient.

Assumptions:

1. The number of patients who need invasive mechanical ventilation exceeds the supply of available ventilators.
2. The usual medical standards of care have been changed to crisis care in the interest of preserving life
3. The usual monitoring techniques for patient care cannot be uniformly utilized
4. Triage processes are enacted that embrace patient acuity, clinical condition(s) and comorbidity have been embraced
5. The facility is a high acuity healthcare facility familiar with advanced mechanical ventilation including prone positioning therapy and is replete with expertise in critical care medicine, respiratory therapy and related fields. The facility is supported by 24/7 critical care medicine, bedside critical care nursing, respiratory therapy, point of care testing, portable radiology, anesthesiology, and pharmacy
6. This technique is to be used while pairing COVID-19 (+) patients with one another or COVID-19 (-) patients with one another; mixing COVID-19 status patients while Co-Venting is not recommended
7. Patients need to be heavily sedated (RASS -4) to suppress their respiratory drive. If sedation is not adequate, neuromuscular blockers may be added to obliterate any respiratory effort
8. This protocol was developed exclusively for Pressure Cycled Modes of ventilation

Criteria:

1. Invasive mechanical ventilation is required to manage work of breathing, hypoxia, hypercarbia or a combination of those conditions
2. The patient's clinical condition is believed to have a reasonable likelihood of salvage

Exclusions:

1. Both patients have tracheostomies (creates an issue with limb clamping to determine delivered volume)
2. Lack of sufficient resources to support complex mechanical ventilation and the bedside clinical management using a geographically fixed team-based approach
3. Cessation of pandemic crisis standards of care

4. Sufficient mechanical ventilators for 1:1 patient: ventilator care

Co-Venting Procedure

Patient should be initially identified as either a PUI (Person under Investigation) or COVID +. If PUI, patient should be allocated to a single ventilator and managed accordingly. If COVID +, patient may be co-vented.

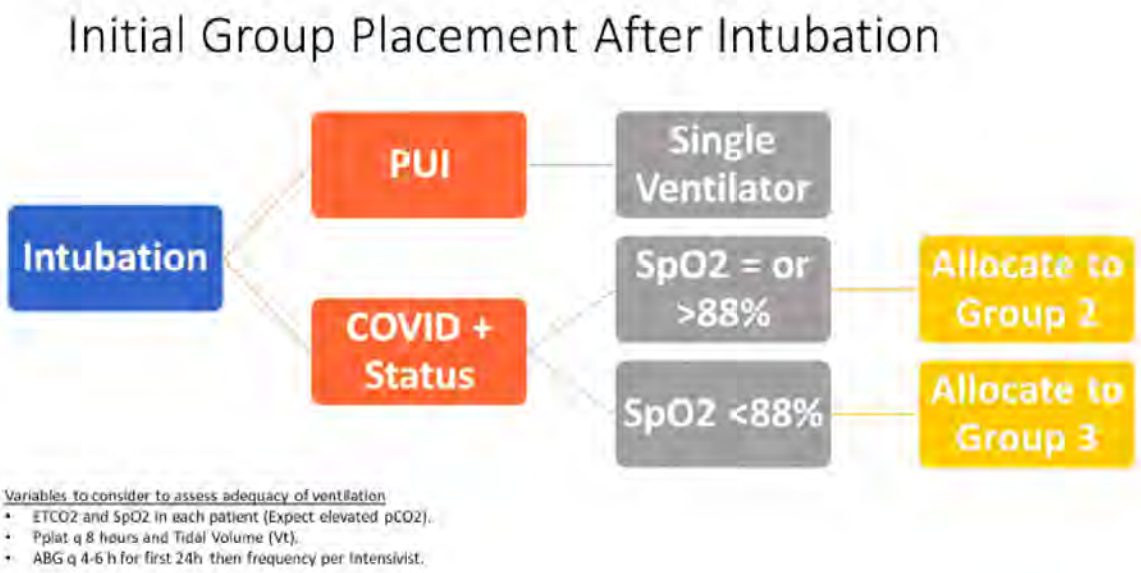
There are 3 situations when Co-venting:

1. *Initial Assessment and Group Assignment of the Newly Intubated Patient*

After intubation, oxygen requirements should be assessed. If SpaO2 is = or > 88% with usual manual bag ventilation, patient should be allocated to group 2. After 1 hour, ABG, Vt, ETCO2 and SpO2 should be assessed to determine if the patient is appropriate to remain in Group 2.

> The **estimated tidal volume** for patient A can be determined by clamping the ET tube of patient B for 3 breaths, and observe the tidal volume (TV) delivered on the ventilator to patient A (which reveals the TV to patient A), and subtract from the total volume (to both patients) to estimate the TV for patient B.

On the other hand, if SpO2 is <88% with manual bag ventilation, patient should be allocated to Group 3. Parameters (ABG, Vt, ETCO2 and SpO2) should again be assessed after 1 hour to determine if the patient is appropriate to remain in Group 3.



2. *Co-Venting of Existing Ventilated Patients*

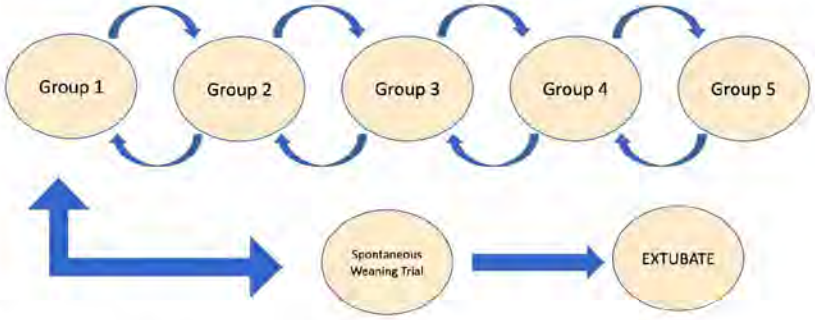
If patients are being separately vented, and there is consideration to choose 2 to be co-vented, clinicians can use the current ventilator parameters of the patients to determine who best to co-vent. Effort should be made to match compliances, minute ventilation, PEEP and O2 requirements to the greatest extent possible.

3. *Reassessment and Group Reassignment*

If after 1 hour the SpO2 is less 88%, patient should be reallocated to the next higher group. We accept a lower SpO2 in this situation Subsequent group changes should be prompted by changes in oxygenation and ventilation status as deemed appropriate. For Group 5 patients who continue to decompensate, Inverse Ratio Ventilation (IRV) can be considered. In a similar fashion, patients that show improvement, can be reallocated to a lower Group.

For patients in Group 2 who are thought to be ready to wean, reallocation to Group 1 can be pursued. Once stability in Group 1 has been noted for at least 1 hour then patient can be moved, ideally, to an independent ventilator for spontaneous weaning trial.

Group Transitions



Considerations

- Always set ventilator to 100% FiO2 when a patient is being added to a new group until further assessed (see text).
- Criteria for Transition between groups per measured parameters (ABG, SpO2, Vt and ETCO2). *See text.*

PC Settings and PEEP By Group

Group	PC	FIO2	PEEP
2	20-25	40	10
3	25-30	90	14
4	30-35	100	18
5	35-40*	100	22

Group 1: Patients deemed appropriate for weaning using 40% O_2/+5 PEEP

Determine Group mobility using:
ABG/VBG, Pplat, VT (if measurable), ETCO2, SaO2

*Group 5 patients with persistent failure → consider IRV

Limitations/challenges

1. Co-Venting should be considered only in COVID-19 confirmed cases. If COVID-19 status is unknown, a single ventilator should be used with only one patient connected.
2. Once COVID-19 status has been confirmed positive, begin to group COVID-19 (+) patients with similar degrees of pulmonary dysfunction (i.e. compliance).
3. Active exacerbation of asthma/COPD (i.e. wheezing/active obstructive disease) is an ABSOLUTE CONTRAINDICTION to be co-ventilated as it substantially complicates respiratory parameter assessment and joint patient management.
4. Expect hypercarbia with the initiation of, and perhaps throughout the process of Co-Venting. If patients are hemodynamically stable, no changes to ventilator settings may be required. If hemodynamically unstable, consider alternate options to address the impact of hypercarbia on pH, based on patient status and other existing or evolving organ failures (i.e. acute kidney injury).
5. Patient ventilatory asynchrony may occur due to an inadequately sedated patient trying to initiate a breath. This could lead to further lung injury of both Co-Vented patients. If this occurs, re-assess sedation level and consider the use of neuromuscular blocking agents in concert with sedation and analgesia to avoid the recall phenomenon.
6. Dramatic changes in ventilator settings are discouraged. However, if changes are necessary, it is prudent to change only one parameter at a time, and in only small increments (i.e. rate change by no more than 4 breaths per minute to adjust minute ventilation). Reassessment is then required as above to assess impact.
7. ***Alveolar Derecruitment Prevention Procedure:*** To avoid alveolar de-recruitment when breaking the ventilator circuit, use a tube clamp to temporarily occlude the proximal endotracheal tube (ETT) (avoiding clamping the ETT pilot balloon inflation line) and the wye angled adaptor (Image 2 below) to keep the circuit sealed as needed.
8. Whenever the circuit is breached (i.e. changing of heat-moisture exchanger filter (HMEF) or expiratory port filter), clamp the proximal ETT (avoiding clamping the ETT pilot balloon inflation line) to avoid aerosolization and potential pathogen spread. This procedure is analogous to the alveolar derecruitment prevention procedure above.
9. If tidal volumes suddenly or unexpectedly drop, consider a HMEF malfunction (i.e. condensation/sputum/ etc. in the HMEF); follow the above alveolar derecruitment prevention procedure, replace the HMEF and reassess.
10. If using off the shelf (i.e. Hardware store) parts, ensure that they are appropriately cleaned/decontaminated prior to inclusion in a patient circuit.
11. We discourage attempting to wean patients while they are being Co-Vented. Instead, patients suitable for weaning are recommended to be managed on a dedicated ventilator.
12. If one of the Co-Vented patients suffers cardiac arrest and the circuit must be separated, consider the following options to optimize safety:
    a. Disconnect the arrested patient from the circuit to manually bag during the cardiac arrest. Occlude the ETT port of the circuit by using the elbow and cap included with wye connector that comes with standard ventilator circuit. (NOTE: Consider taping the wye angled adaptor and cap to either the ventilator or ventilator circuit so that it is readily visible and available in case of emergency).

Also, prior to removing the arrested patient from the circuit, follow the alveolar derecruitment prevention procedure detailed above for the non-arresting patient prior to depressurizing the system.

b. Disconnect the T-tube splitter at the expiratory and inspiratory port and quickly convert to a single ventilator circuit to support the non-cardiac arrested patient. NOTE: use a temporary tube clamp for the non-arrested patient ETT during transition to a dedicated ventilator circuit to avoid alveolar de-recruitment.

13. In situations where a Co-Vented patient must be disconnected for procedures (i.e. CT scan etc.), use the elbow and cap procedure as described above to avoid de-recruitment of the other patient.
14. If proning is considered for Co-Vented patients, it should be done by those skilled in prone positioning. Prone position therapy is recommended only for patients meeting the Berlin criteria for severe ARDS. Challenges and potential issues that may occur while using prone positioning therapy for COVID-19(+) Co-Vented patients include but are not limited to:
    a. An increased risk of aerosolization if the ventilator circuit becomes disconnected during the proning process
    b. The number of personnel required to participate in prone positioning will increase the number of personnel with potential exposure
    c. Co-Vented patients should be sequentially proned to allow reassessment of hemodynamics and ventilator dynamics that may not be predictable; do not attempt to prone patients at the same time
    d. Both patients require reassessment after one patient is proned, not just the patient who is in the prone position
    e. The use of a specialty bed for prone positioning is discouraged due to the potential risk of iatrogenic harm to the other Co-Vented patient.

15. Ethical and legal considerations:
    a. The use of one ventilator for 2 patients (i.e. co-venting) has substantial ethical and legal implications. Please refer to your hospital disaster protocol and or the National disaster plan regarding the specific approach your facility recommends. Specific concerns include:
        i. Off label use
        ii. Use in Disaster situations
16. Room placement of a ventilator used for Co-Venting
    a. Many ICU rooms may be too small to accommodate two patients at the same time. It is recommended to place beds side by side with the ventilator positioned at the head of the beds or between the beds.
    b. If a larger space is available, a head-to-head configuration is ideal to facilitate axial repositioning of patients and care devices.
17. Appropriate labeling of equipment that is to be used for patient care in order to distinguish connections to Patient A compared to Patient B is ***critical***. This includes the patient, IV pumps and tubing, physiologic monitors, ventilator circuits, drains, chest tubes, etc. Consider a color-coding system or similar approach to be certain of which device connects to which patient to avoid iatrogenic harm.

Respiratory Therapy Guide to Co-Ventilation

This document highlights key points for the Respiratory Therapist's role in placing 2 adult patients in a co-venting or ventilator sharing system.

FOR PURPOSES OF CLAIRITY, PATIENT B IS ASSUMED TO BE THE PATIENT ADDED OR REMOVED FROM THE CIRCUIT.

CAUTION: IN THE EVENT OF AN EMERGENCY WHERE PATIENT B HAS TO BE REMOVED FROM THE SYSTEM, PATIENT A'S ET TUBE MUST BE CLAMPED (PER ALVEOLAR DERECUITMENT PREVENTION PROCEDURE) AND THE VENTILATOR CIRCUIT FROM PATIENT B MUST BE SEALED TO MAINTAIN PEEP AND VENTILATION FOR PATIENT A. USE THE WYE ANGLED ADAPTER AND CAP THAT COVERS THE WYE (COMES WITH THE VENILATION CIRCUIT) TO CLOSE THE VENTILATOR CIRCUIT TO PATIENT B.

- **Supplies to be available in room before intubation**
  - Tube Clamps (one for each patient) and Terminal ET connection cap (tape to vent)
  - Ventilator
  - Elbow adaptor with cap from standard ventilator tubing circuit (tape to vent)
  - 2 vent splitters (one for inspiratory and one for expiratory circuits)
  - BVM: Bag Valve Manual resuscitator bag with mask, bacterial/viral filter and minimum 10 cmH_2O PEEP valve (Ideally place another bacterial / viral filter between BVM expiratory port and PEEP valve.)
  - Heat Moisture Exchanger Filter (HMEF) Before ETT
  - 2 bacterial/viral filters at T piece of expiration port.
  - SpO_2 probe/monitor
  - In-line suction catheter
  - Intubation Equipment (if not already intubated)
    - GlideScope (preferred for decreased infection exposure)/ Laryngoscope
    - Stylet
    - ET tubes of different sizes
    - 10 ml Syringe to inflate ETT cuff
    - Suction equipment
    - Functioning oxygen flow meter for BVM
    - ETT facial securement device (or tape)

- **Ventilator Set-up**
  - End-tidal CO_2 monitor (if available)
  - Set ventilator in a pressure-oriented mode (i.e. Pressure Control Ventilation)
  - Trigger sensitivities (either pressure or flow) should be set as high as allowed by the ventilator ("locked - out") to minimize risk of patient-to-patient ventilator interactions
  - If creating a new group, request settings from the managing clinician
  - If adding to an existing patient:
    - Temporarily set FiO_2 to 100% when a patient is being added

        - Ensure ET tube of existing patient is clamped to prevent de-recruitment when the system depressurizes as the new patient is added
        - Allow the system to re-pressurize 3 breaths prior to unclamping ET tubes
        - Set FiO2 to level requested by clinician
- **Tidal Volume Monitoring**
    - Measure at minimum every 4 hours for each patient. Necessity of more frequent checks must be balanced with healthcare worker exposure risk
    - Procedure
        - Record Vt while both patients are being ventilated at baseline (Initial Vt)
        - Using a Tube Clamp, clamp the ET tube of patient A
        - Allow ventilator to deliver 3 breaths. Vt measured will be the estimated patient B Vt.
        - Unclamp patient A
        - Subtract patient's B Vt from initial Vt to obtain Vt of patient A. (Initial Vt – patient B Vt = patient A Vt)
- **Ventilator Goals**
    - Only make adjustments to one parameter at a time and reassess
    - If SpO_2 <88%, alert clinician for possible transition to a higher group
    - Expect and allow hypercarbia
- **Items of Note**
    - Ventilator may autocycle with suctioning
    - Check heat/moisture exchanger (HME) for blockage if there is a sudden drop in Vt
    - Check connections frequently and with every ventilator check

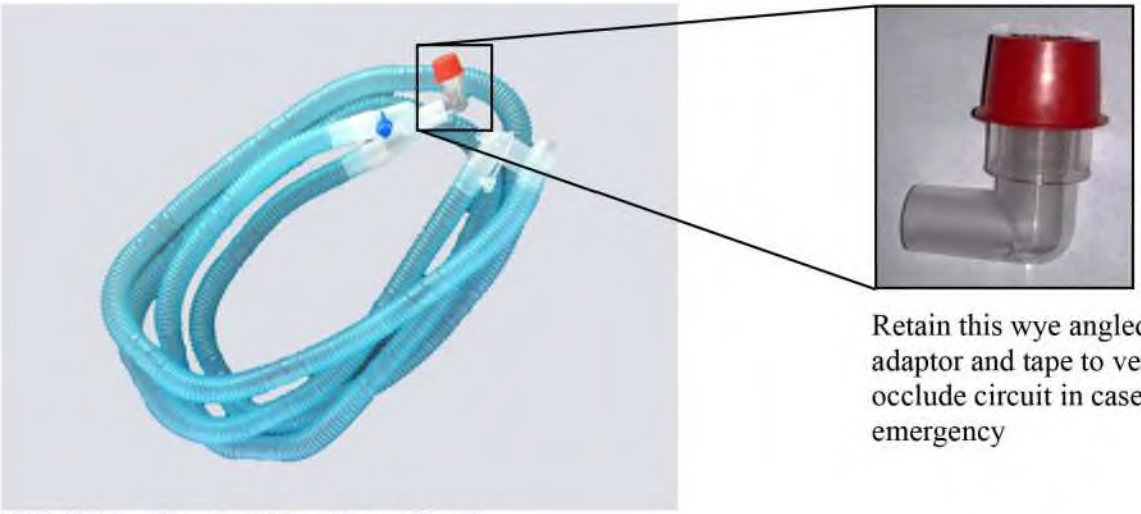
Co-venting 2 Patients With 1 Vent Supply List

Overview and Testing: https://youtu.be/SKh-QHMAKhc

- 2 Plastic Tube Clamps (Image 1)

- 2 Standard Ventilation circuits. Each circuit should include (Image 2)
    - 6 feet Inspiratory corrugated tubing
    - 6 feet Expiratory corrugated tubing
    - 1 wye adaptor
    - 1 capped angled wye adaptor (tape to vent to prevent loss)
- 3 bacterial filter (Image 3)
- 2 heat moisture exchange/filter (HMEF) (Image 4)
- 2 inline suction catheters (Image 5)
- Tee connector Options
    - Option 1 (hospital sourced- Preferred)
        - 2 Tee adaptors cut from Aerosol Drainage Bag (Image 6)
        - 2 Female to Female adapter (in order of preference)
            - 22 mm adaptor (Image 7)
            - Short corrugated tube from small volume jet nebulizer setup (Image 8)
            - Cut piece of standard large bore tubing (Image 9)
    - Option 2 (community sourced – if insufficient hospital supply)
        - 2 CPVC CTS ¾ inch Tee (Image 10)
            - CTS= Copper Tube Size (ASTM D2846)
        - 6 male to male adaptors
            - Hospital sourced 15 mm adapters (Image 11)
            - ¾ CPVC CTS pipe cut to 4 cm (Image 12)
                - CTS= Copper Tube Size

IMAGE 1- Plastic Tube Clamp



Retain this wye angled adaptor and tape to vent to occlude circuit in case of emergency

IMAGE 2 – Standard Ventilator Circuit

IMAGE 3 – Bacterial Filter

IMAGE 4 - Heat moisture exchange/filter (HMEF)

IMAGE 5 – Suction Inline Catheters

IMAGE 6 – Tee Connector cut from Aerosol Drainage Bag

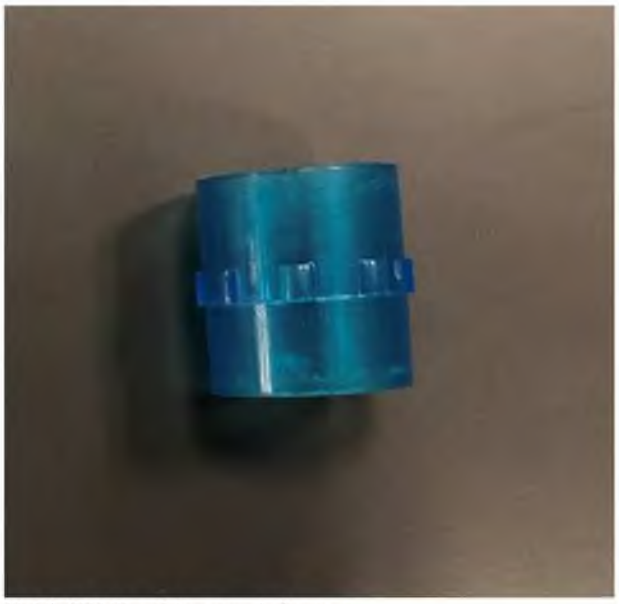


IMAGE 7 – 22 mm Adaptor

IMAGE 8 - Short corrugated tube from small volume jet nebulizer

IMAGE 9 - Cut piece of standard large bore tubing

IMAGE 10 – CPVC ¾ inch Tee

IMAGE 11 - Hospital sourced 15 mm adapters

IMAGE 12 - ¾ CPVC pipe cut to 4 cm

Training and Resources
FAQs: (FEMA link). We hope to have this up soon

Video tutorial: available here. https://youtu.be/TNvQb2uFe_Y

24-hr. telephone support for implementation guidance is expected soon.

Database for tracking clinical experience: follow link to portal to enter patient information (FEMA portal)

Conclusion
In light of the ongoing Covid -19 pandemic, the need for mechanical ventilators across the United States may exceed our current supply. In this situation it is incumbent on medical providers and governing bodies to explore and support new strategies to provide the best possible care. This document provides a way to modify a single ventilator for off label use to co-ventilate 2 patients and provides details an initial implementation of a co-ventilation system. As this is a unique use of mechanical ventilation during a pandemic crisis, sharing feedback of implementation experiences, limitations and challenges is strongly encouraged. Please follow the link to the FEMA portal to share experience.

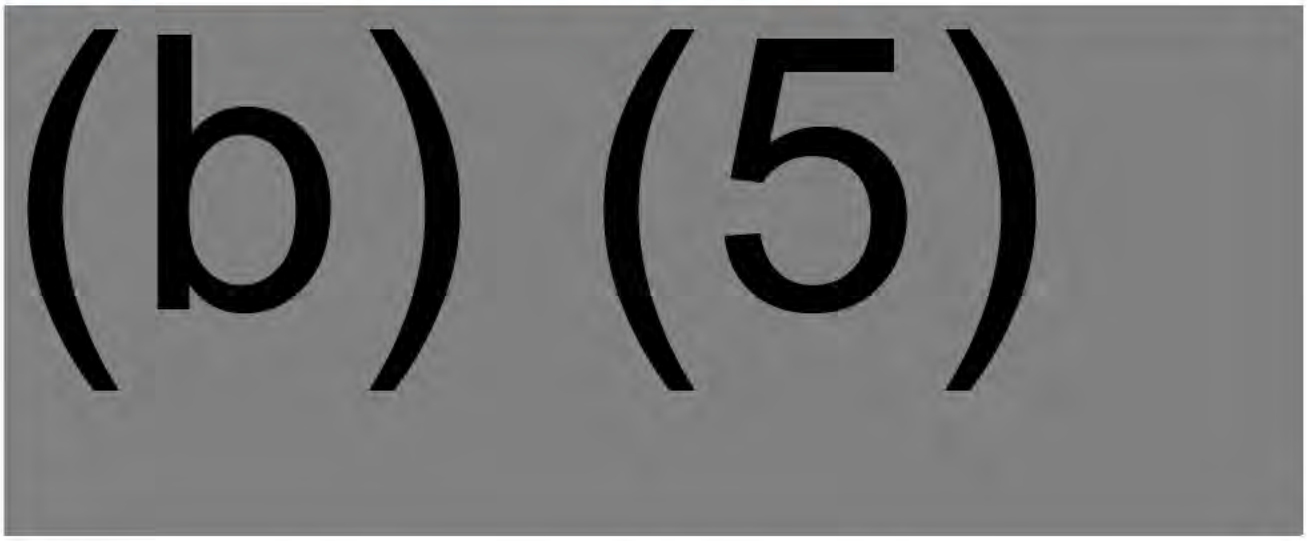
RE: FOR REVIEW - (b) (5)

From "Wilson, Matt B. EOP/OSTP" (b) (6)
:

"Watson, Ian D. EOP/OSTP" (b) (6) >, "Nichols, Lisa M. EOP/OSTP"
To: (b) (6) , "Simon, Ian D. EOP/OSTP (Contractor)"
(b) (6)

Date: Wed, 01 Apr 2020 19:24:25 -0400

(b) (5) :
https://www.youtube.com/watch?v=C_oR0Oaz70k&feature=emb_title



Matt

From: Watson, Ian D. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 7:04 PM
To: Wilson, Matt B. EOP/OSTP (b) (6) Nichols, Lisa M. EOP/OSTP (b) (6) ; Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

It is

Ian D. Watson
Assistant Director for Biotechnology & Biosecurity
Office of Science & Technology Policy
Office: EEOB (b) (6)
Unclass (b) (6)

SIPR: (b) (6)
JWICS (b) (6)
Desk (b) (6)
Cell: (b) (6)

From: Wilson, Matt B. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 6:57 PM
To: Watson, Ian D. EOP/OSTP (b) (6); Nichols, Lisa M. EOP/OSTP (b) (6); Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

(b) (5)

Matt

From: Watson, Ian D. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 6:37 PM
To: Wilson, Matt B. EOP/OSTP (b) (6) Nichols, Lisa M. EOP/OSTP (b) (6); Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

(b) (5) Tammy said around 7:00 or tomorrow morning depending on TF work. (b) (5).

Ian D. Watson
Assistant Director for Biotechnology & Biosecurity
Office of Science & Technology Policy
Office: EEOB (b) (6)
Unclass: (b) (6)
SIPR: (b) (6)
JWICS: (b) (6)
Desk (b) (6)
Cell: (b) (6)

From: Wilson, Matt B. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 5:17 PM
To: Nichols, Lisa M. EOP/OSTP (b) (6) Simon, Ian D. EOP/OSTP (Contractor) (b) (6); Watson, Ian D. EOP/OSTP (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

(b) (5)

I'd like to send something to KD either tonight or by around 9am tomorrow.

(b) (5) Either is fine with me.

Matt

From: Nichols, Lisa M. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 5:02 PM
To: Wilson, Matt B. EOP/OSTP (b) (6); Simon, Ian D. EOP/OSTP (Contractor) (b) (6) Watson, Ian D. EOP/OSTP (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

(b) (5).

From: Wilson, Matt B. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 4:54 PM
To: Simon, Ian D. EOP/OSTP (Contractor) (b) (6); Nichols, Lisa M. EOP/OSTP (b) (6); Watson, Ian D. EOP/OSTP (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

Hi Ian,

(b) (5)

Matt

From: Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Sent: Wednesday, April 1, 2020 4:43 PM
To: Wilson, Matt B. EOP/OSTP (b) (6) Nichols, Lisa M. EOP/OSTP (b) (6); Watson, Ian D. EOP/OSTP (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

Thanks Matt,

(b) (5)

From: Wilson, Matt B. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 2:53 PM
To: Nichols, Lisa M. EOP/OSTP (b) (6) Watson, Ian D. EOP/OSTP (b) (6); Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Subject: FOR REVIEW - (b) (5)

Hi all,

(b) (5)

(b) (5) —I wanted to get this to you all for review before my hour-long meeting at 3pm.

Matt

Matthew B. Wilson, PhD
Senior Policy Analyst
Office of Science and Technology Policy
Executive Office of the President
1650 Pennsylvania Avenue, NW
Washington, DC 20502
(b) (6)

RE: FOR REVIEW - (b) (5)

From: "Wilson, Matt B. EOP/OSTP" (b) (6)

To: "Nichols, Lisa M. EOP/OSTP" (b) (6)

Cc: "Watson, Ian D. EOP/OSTP" (b) (6) "Simon, Ian D. EOP/OSTP (Contractor)" (b) (6)

Date: Thu, 02 Apr 2020 09:57:36 -0400

Attachments: (b) (5)

Attached.

From: Nichols, Lisa M. EOP/OSTP (b) (6)
Sent: Thursday, April 2, 2020 5:08 AM
To: Wilson, Matt B. EOP/OSTP (b) (6)
Cc: Watson, Ian D. EOP/OSTP (b) (6); Simon, Ian D. EOP/OSTP (Contractor) <(b) (6)>
Subject: RE: FOR REVIEW - (b) (5)

Sorry, please use this version.

From: Nichols, Lisa M. EOP/OSTP
Sent: Wednesday, April 1, 2020 11:26 PM
To: Wilson, Matt B. EOP/OSTP (b) (6)
Cc: Watson, Ian D. EOP/OSTP (b) (6) Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

(b) (5)

Lisa

From: Wilson, Matt B. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 6:55 PM
To: Nichols, Lisa M. EOP/OSTP (b) (6) >
Cc: Watson, Ian D. EOP/OSTP (b) (6); Simon, Ian D. EOP/OSTP (Contractor)

(b) (6)
Subject: RE: FOR REVIEW -(b) (5)

Lisa, (b) (5)

Matt

From: Watson, Ian D. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 6:35 PM
To: Wilson, Matt B. EOP/OSTP(b) (6) Simon, Ian D. EOP/OSTP (Contractor) (b) (6) Nichols, Lisa M. EOP/OSTP(b) (6)
Subject: RE: FOR REVIEW -(b) (5)

(b) (5)

Ian D. Watson
Assistant Director for Biotechnology & Biosecurity
Office of Science & Technology Policy
Office: EEOB(b) (6)
Unclass (b) (6)
SIPR: (b) (6)
JWICS: (b) (6)
Desk: (b) (6)
Cell: (b) (6)

From: Wilson, Matt B. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 4:54 PM
To: Simon, Ian D. EOP/OSTP (Contractor) (b) (6) Nichols, Lisa M. EOP/OSTP (b) (6) Watson, Ian D. EOP/OSTP (b) (6)
Subject: RE: FOR REVIEW -(b) (5)

Hi Ian,

(b) (5)

Matt

From: Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Sent: Wednesday, April 1, 2020 4:43 PM
To: Wilson, Matt B. EOP/OSTP (b) (6) Nichols, Lisa M. EOP/OSTP (b) (6) Watson, Ian D. EOP/OSTP (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

Thanks Matt,

(b) (5)

From: Wilson, Matt B. EOP/OSTP (b) (6)
Sent: Wednesday, April 1, 2020 2:53 PM
To: Nichols, Lisa M. EOP/OSTP (b) (6); Watson, Ian D. EOP/OSTP (b) (6); Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Subject: FOR REVIEW - (b) (5)

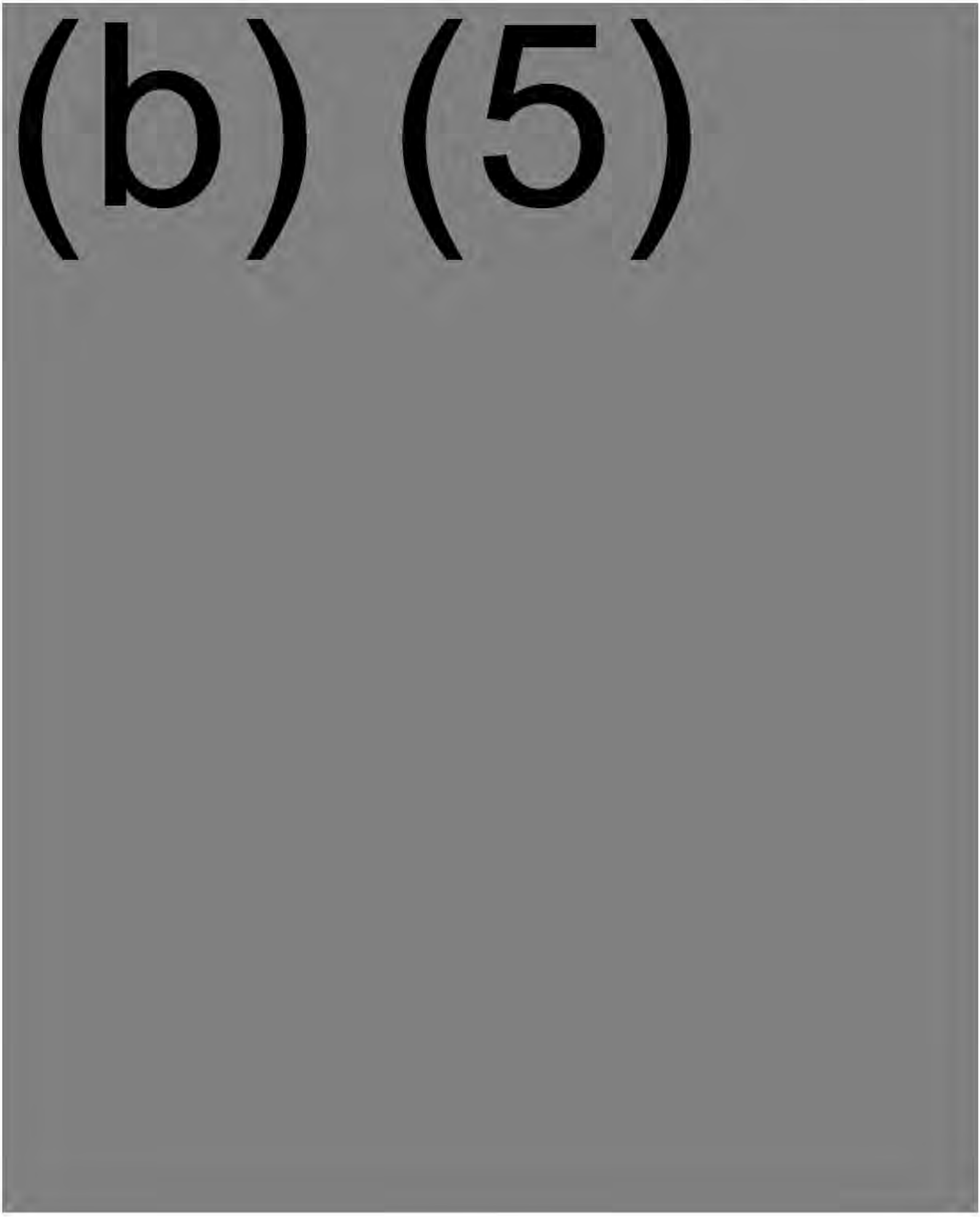
Hi all,

(b) (5)

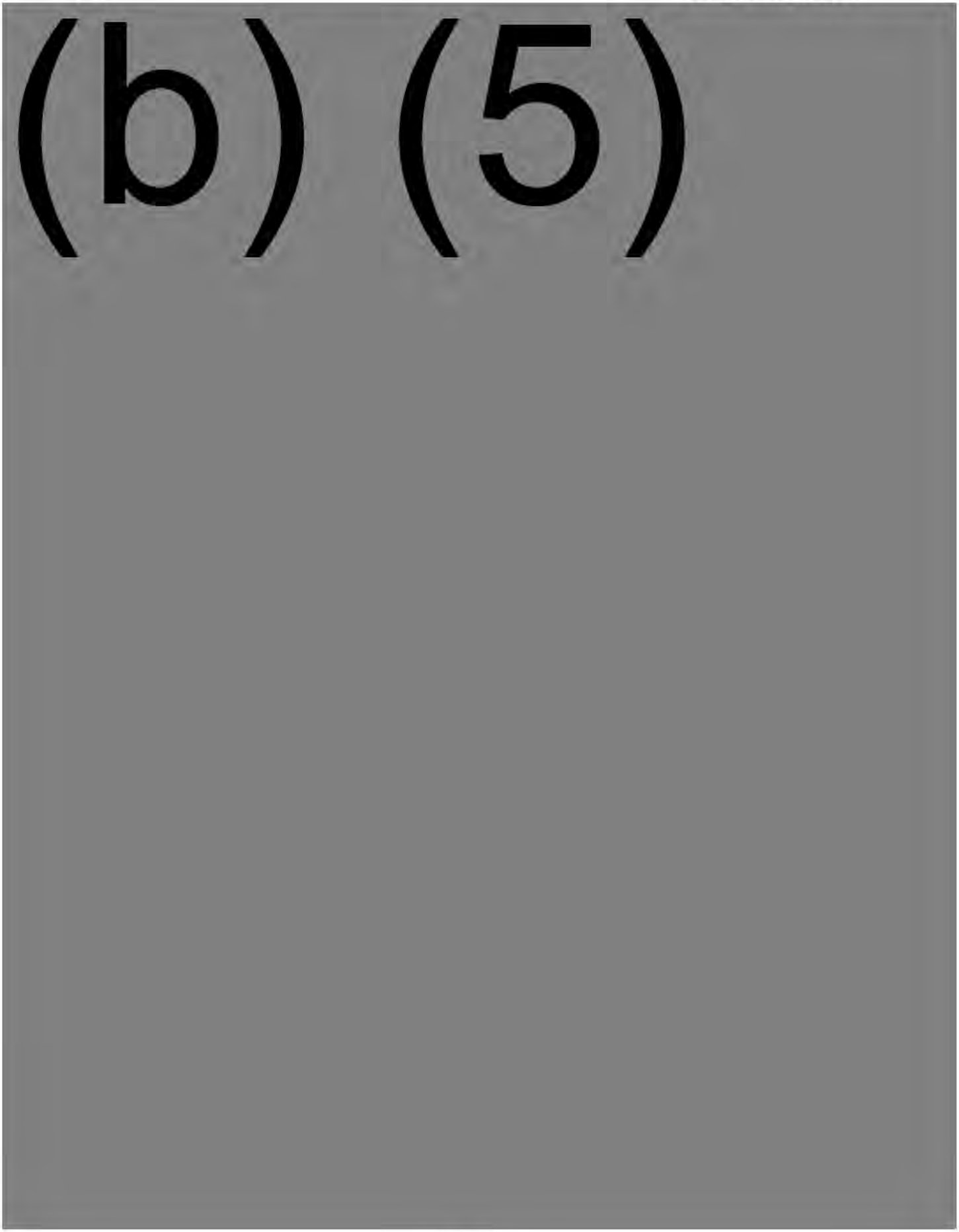
(b) (5) —I wanted to get this to you all for review before my hour-long meeting at 3pm.

Matt

Matthew B. Wilson, PhD
Senior Policy Analyst
Office of Science and Technology Policy
Executive Office of the President
1650 Pennsylvania Avenue, NW
Washington, DC 20502
(b) (6)


(b) (5)

(b) (5)


(b) (5)

RE: [EXTERNAL] FW: A Message from Marillyn: Contributing to COVID-19 Relief and Recovery Efforts

From: "Samanta Roy, Robie" (b) (6)

To: "Bonyun, Sean C. EOP/OSTP" (b) (6)

Date: Fri, 03 Apr 2020 12:22:29 -0400

Attachments: Lockheed Martin Statement 4.4.20.pdf (127.16 kB)

Hi Sean, FYSA, another communication from our CEO on the COVID-19 situation.
Hope you are staying safe and healthy.
Best,
Robie

From: Bonyun, Sean C. EOP/OSTP (b) (6)
Sent: Friday, March 27, 2020 6:34 PM
To: Samanta Roy, Robie (US) (b) (6)
Subject: EXTERNAL: Re: [EXTERNAL] FW: A Message from Marillyn: Contributing to COVID-19 Relief and Recovery Efforts

Many thanks for sending Robie - have passed along to Michael. Hope that you have a nice weekend and stay safe.

Best,
Sean

On Mar 27, 2020, at 5:21 PM, Samanta Roy, Robie (b) (6) wrote:

Hi Sean,
Would you please pass on to Michael for his awareness.
Thank you and stay safe.
Robie

Robie I. Samanta Roy, Ph.D.
Vice President, Technology, Government Affairs
Lockheed Martin Corporation
2121 Crystal Drive, Arlington, VA 22202
Tel: (b) (6)
"All truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as self-evident." – Arthur Schopenhauer

From: Communications, Corporate (RESOURCE) (b) (6) >
Sent: Friday, March 27, 2020 1:17 PM
To: dl-Employees, US (b) (6)
Subject: A Message from Marillyn: Contributing to COVID-19 Relief and Recovery Efforts

<ATT00001.jpg>

March 27, 2020

Today, I want to follow up and share with you what Lockheed Martin is doing to contribute to relief and recovery efforts in the global fight against COVID-19.

First, I want to thank you. Because of your outstanding performance during this crisis and over the past several years, we are well-positioned to make a difference at a critical time. As a company, we are strong and stable, and we are resolved to use our know-how, resources, and leadership to assist our communities during this global crisis.

To this end, Lockheed Martin will take the following steps as an initial contribution to the COVID-19 relief and recovery effort:

- We will advance more than $50 million to small- and medium-sized business partners in our supply chain to ensure they have the financial means to continue to operate, sustain jobs, and support the economy.
- We will donate $10 million to non-profit organizations involved in COVID-19-related relief and assistance, with emphasis on veterans and military families.
- We have activated a $6.5 million employee disaster relief fund to assist Lockheed Martin employees and retirees impacted with COVID-19.

These are our initial financial steps to help during this time of need. In addition:

- We will offer Lockheed Martin's engineering and technical capabilities to help solve the most pressing challenges faced by federal, state, and local officials.

- We will donate the use of our corporate aircraft and vehicle fleet for COVID-19 relief logistical support and medical supply delivery.

- We will donate the use of our facilities for crisis-related activities including critical medical supply storage, distribution, and COVID-19 testing, where needed and practical.

- Finally, during this time of economic uncertainty, we will continue our planned recruiting and hiring. Given the requirement for social distancing, Lockheed Martin will deploy virtual technology and other techniques to sustain our hiring activity during this crisis period.

The shared effort to combat COVID-19 and recover from its effects will be a long-term one. As a company, we will continue to engage national, state, and local leaders to undertake additional measures as needed.

And, throughout this crisis, I thank you for your energy and dedication, as we continue to deliver critical capabilities for the United States and our allies, support job creation and economic recovery, and help those in need wherever we operate.
<image002.jpg>
Marillyn A. Hewson
Chairman, President and CEO

LOCKHEED MARTIN

News Release

STATEMENT BY MARILLYN HEWSON ON LOCKHEED MARTIN ADDITIONAL SUPPORT OF COVID-19 RELIEF AND RECOVERY EFFORTS

BETHESDA, Md., April 3, 2020 – Today, Lockheed Martin is announcing a number of additional steps we are taking to continue supporting our employees, vulnerable companies in our supply chain and those on the front lines of the medical crisis impacting our local communities and the nation.

- In addition to continuing to support our key government customers, we recognize that providing jobs during this period of economic downturn is also critically important. We are committed to continue hiring during this crisis and have added close to 1,000 new employees over the past two weeks in addition to advertising for 5,000 open positions.

- Recognizing that our workforce is our most valuable asset in supporting our national security mission, we are extending awards of up to $500 to our employees who are regularly required to work at, or travel to, a designated Lockheed Martin facility or customer site during this crisis.

- To continue supporting the small businesses and supply chain that power our U.S. defense industrial base, we are increasing our previous commitment of $53 million in accelerated payments by another $53 million, totaling more than $106 million for this purpose.

- To support our first responders and health care workers on the front lines of this crisis, we are committing to donate $2 million in urgently needed personal protective equipment items.

- In addition, we have donated personal protective equipment (PPE) for urgent need at local hospitals and have also initiated limited PPE and medical device production (face shields). We are also providing engineering support for select initiatives to accelerate production of PPE equipment.

As we all deal with the challenges of the health crisis, we will continue to perform and deliver critical products and capabilities for the United States and our allies, support job creation and help those in need wherever we operate.

Marillyn Hewson
Chairman, President and CEO
Lockheed Martin Corporation

About Lockheed Martin

Headquartered in Bethesda, Maryland, Lockheed Martin is a global security and aerospace company that employs approximately 110,000 people worldwide and is principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products and services.

# # #

Media Contact:
Jarrod Agen, 301-897-6412, jarrod.p.agen@lmco.com

RE: FOR REVIEW - (b) (5)

From "Waterman, Paige E. EOP/OSTP" (b) (6)
:

To: "Wilson, Matt B. EOP/OSTP" (b) (6)

Date: Fri, 03 Apr 2020 10:11:15 -0400

(b) (5)

From: Watson, Ian D. EOP/OSTP (b) (6)
Sent: Friday, April 3, 2020 10:03 AM
To: Waterman, Paige E. EOP/OSTP (b) (6); Wilson, Matt B. EOP/OSTP (b) (6); Nichols, Lisa M. EOP/OSTP (b) (6) Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

(b) (5)

(b) (5)

Ian D. Watson
Assistant Director for Biotechnology & Biosecurity
Office of Science & Technology Policy
Executive Office of the President
Eisenhower Executive Office Building, Rm. (b) (6)
1650 Pennsylvania Ave, N.W.
Washington, D.C. 20502
Unclass (b) (6)
SIPR: (b) (6)
JWICS (b) (6)
Desk: (b) (6)
Cell: (b) (6)

From: Droegemeier, Kelvin K. EOP/OSTP (b) (6)
Sent: Thursday, April 2, 2020 7:02 PM
To: Waterman, Paige E. EOP/OSTP (b) (6) Wilson, Matt B. EOP/OSTP (b) (6)
Cc: Nichols, Lisa M. EOP/OSTP (b) (6); Watson, Ian D. EOP/OSTP (b) (6); Simon, Ian D. EOP/OSTP (Contractor) (b) (6) Bonyun, Sean C. EOP/OSTP (b) (6) Hunter, Jordan C. EOP/OSTP (b) (6); Baum, Kristina R. EOP/OSTP (b) (6) Droegemeier, Kelvin K. EOP/OSTP (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

Hi folks,

Sorry for the late reply. Please see attached for comments and suggested edits.

Kelvin

From: Waterman, Paige E. EOP/OSTP (b) (6)
Sent: Thursday, April 2, 2020 11:54 AM
To: Wilson, Matt B. EOP/OSTP (b) (6); Droegemeier, Kelvin K. EOP/OSTP (b) (6)
Cc: Nichols, Lisa M. EOP/OSTP (b) (6) Watson, Ian D. EOP/OSTP (b) (6) Simon, Ian D. EOP/OSTP (Contractor) (b) (6) Bonyun, Sean C. EOP/OSTP (b) (6) Hunter, Jordan C. EOP/OSTP (b) (6) Baum, Kristina R. EOP/OSTP (b) (6)
Subject: RE: FOR REVIEW - (b) (5)

Great work all - (b) (5)

Paige

From: Wilson, Matt B. EOP/OSTP (b) (6)
Sent: Thursday, April 2, 2020 10:04 AM
To: Droegemeier, Kelvin K. EOP/OSTP (b) (6)
Cc: Nichols, Lisa M. EOP/OSTP (b) (6); Watson, Ian D. EOP/OSTP (b) (6)>; Simon, Ian D. EOP/OSTP (Contractor) (b) (6)
Bonyun, Sean C. EOP/OSTP (b) (6) Hunter, Jordan C. EOP/OSTP (b) (6) Baum, Kristina R. EOP/OSTP (b) (6)
Waterman, Paige E. EOP/OSTP (b) (6)
Subject: FOR REVIEW - (b) (5)

Dear Kelvin,

(b) (5)

(b) (5). Thanks!

Matt

Matthew B. Wilson, PhD
Senior Policy Analyst
Office of Science and Technology Policy
Executive Office of the President
1650 Pennsylvania Avenue, NW
Washington, DC 20502
(b) (6)

RE: Spreadsheet

From: "Kjelland, Christin C. EOP/OSTP" <(b) (6)

To: "Droegemeier, Kelvin K. EOP/OSTP" <(b) (6)

Date: Mon, 06 Apr 2020 09:26:40 -0400

Attachments: COVID19 Research (b) (5)

Hi Kelvin,

(b) (5)

Best,
Christin

From: Droegemeier, Kelvin K. EOP/OSTP <(b) (6)
Sent: Monday, April 6, 2020 8:40 AM
To: Kjelland, Christin C. EOP/OSTP (b) (6)
Subject: Spreadsheet

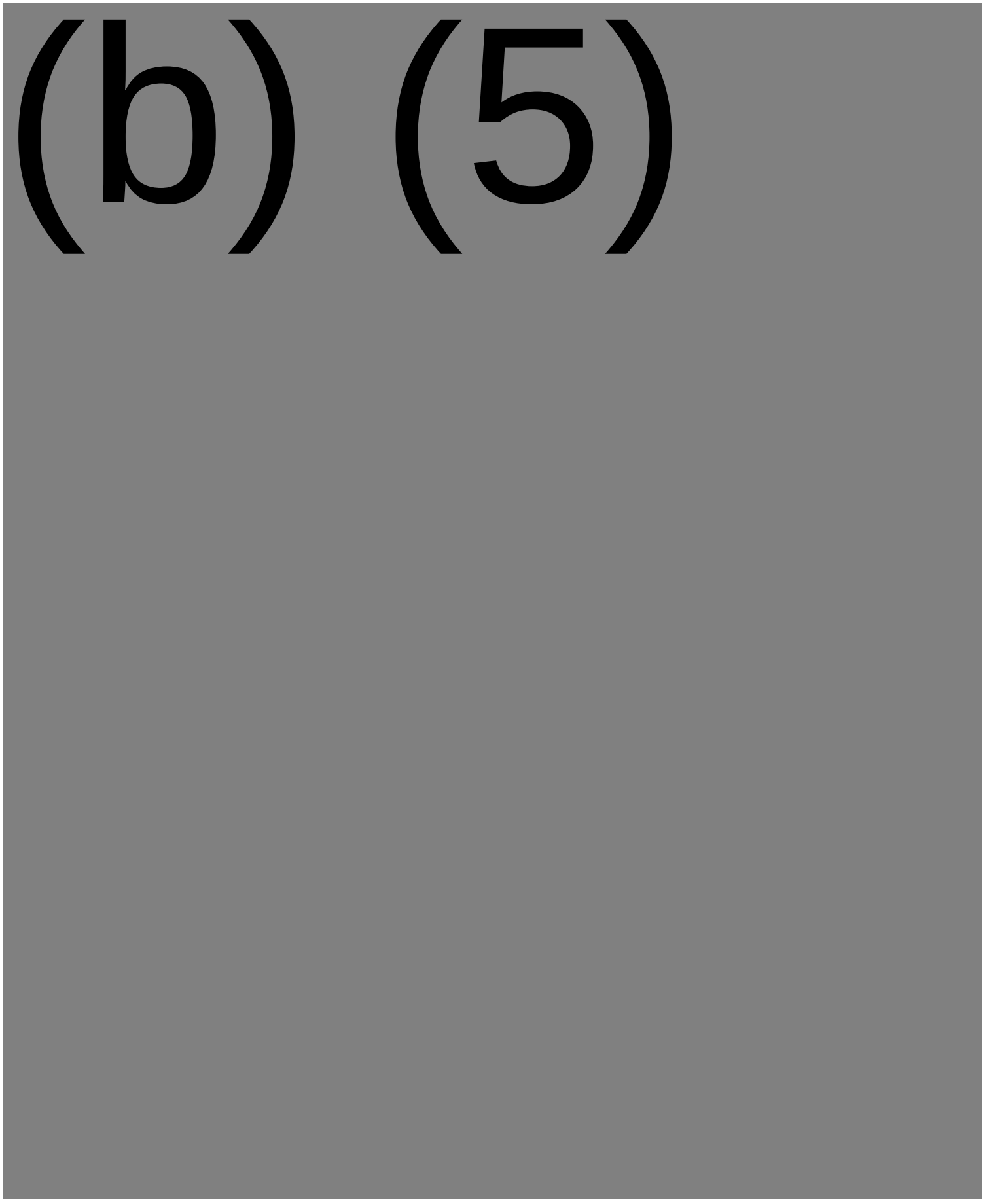
Hi Christin,

(b) (5)

Thank you!!

Kelvin

Dr. Kelvin K. Droegemeier, Director
Office of Science and Technology Policy
The White House
Washington, DC 20502
(202) 456-4444
http://www.ostp.gov
@WHOSTP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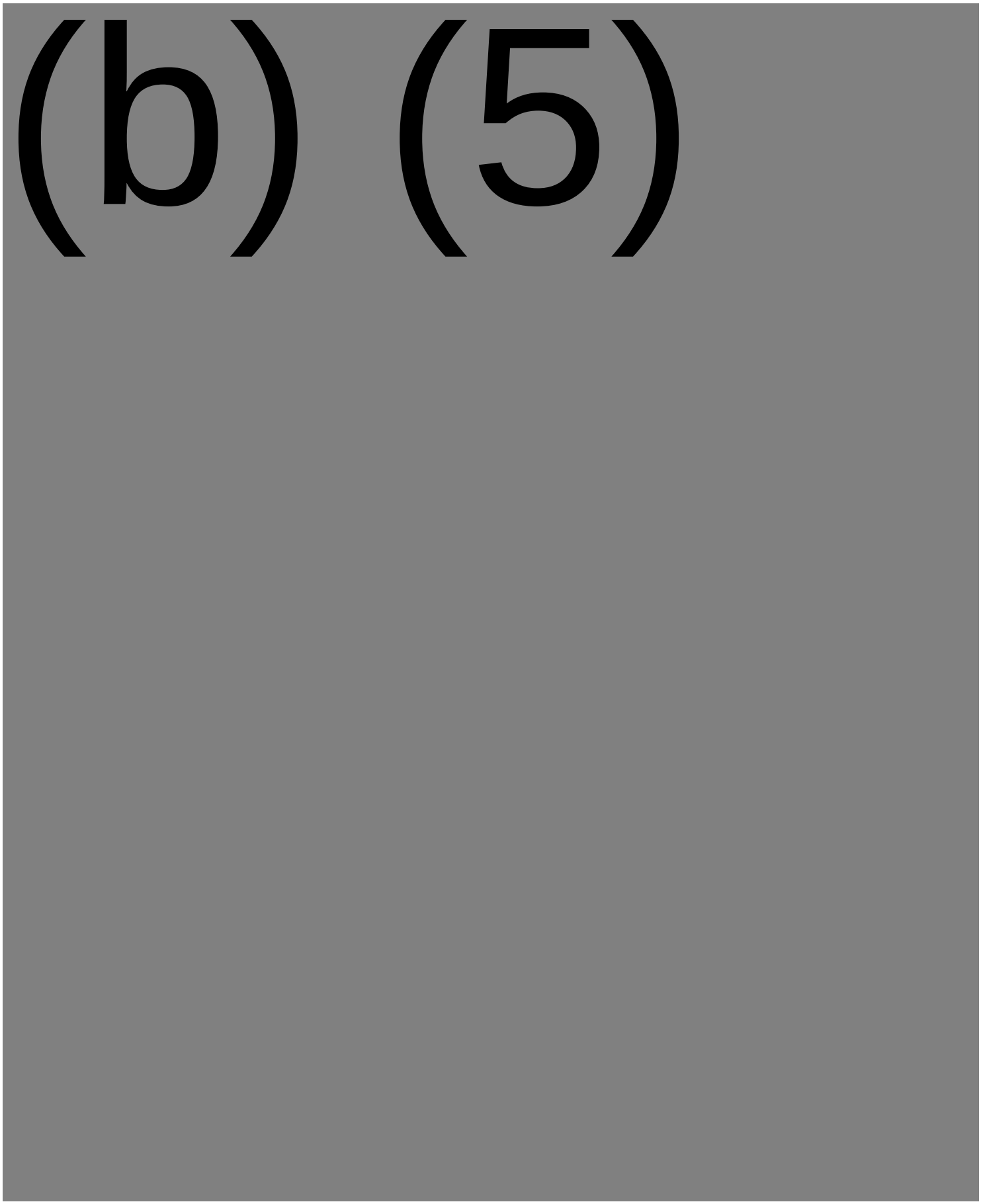
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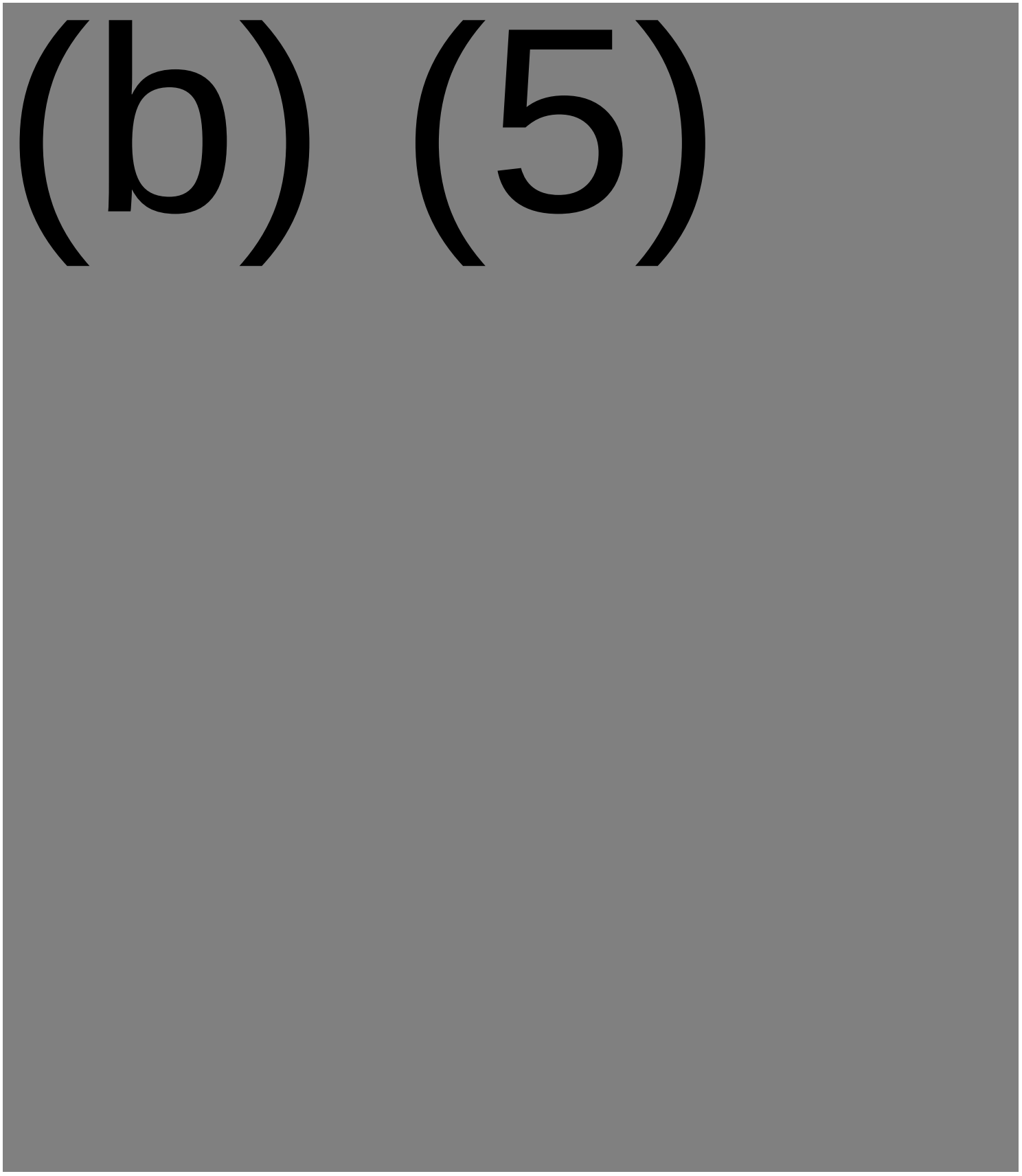
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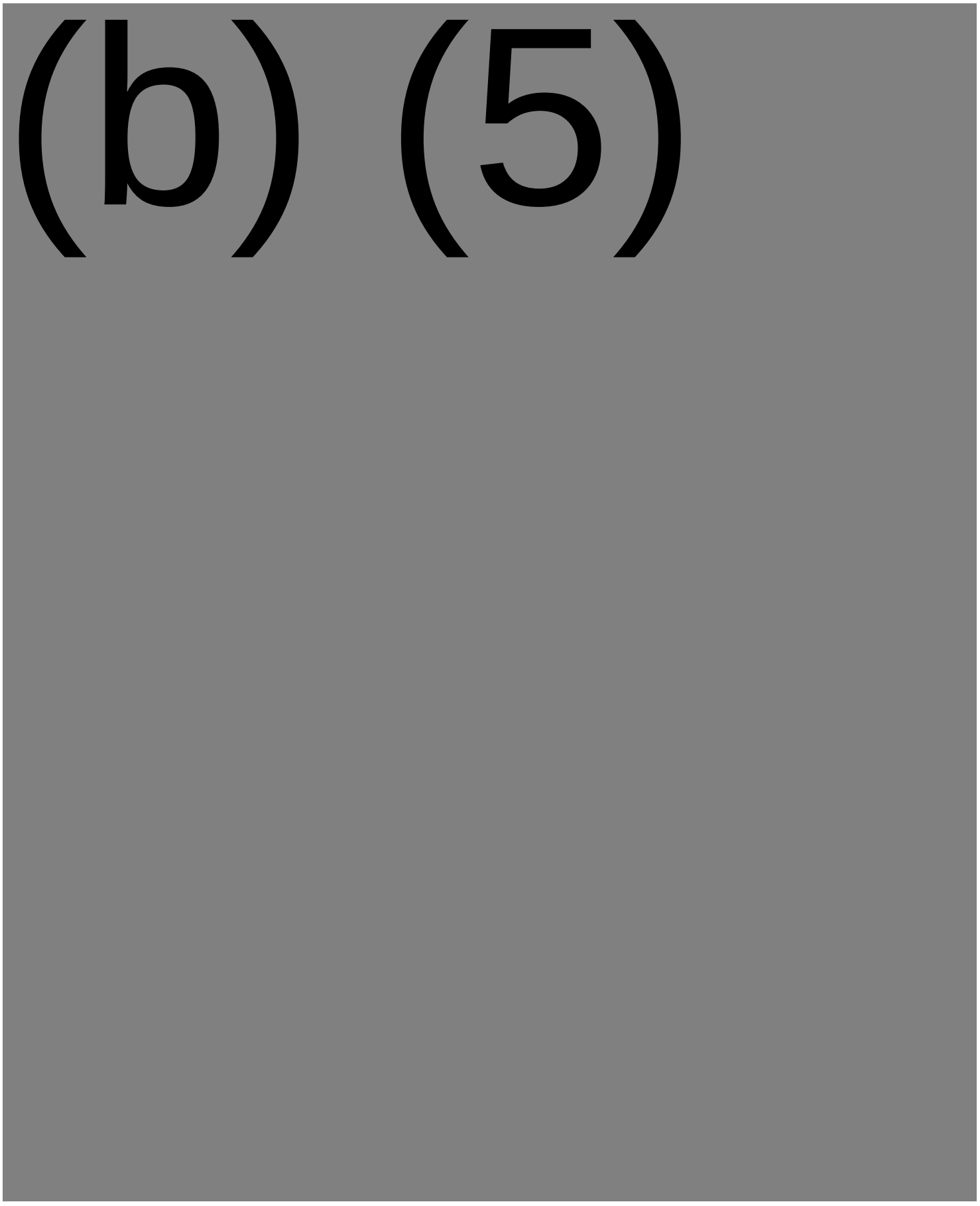
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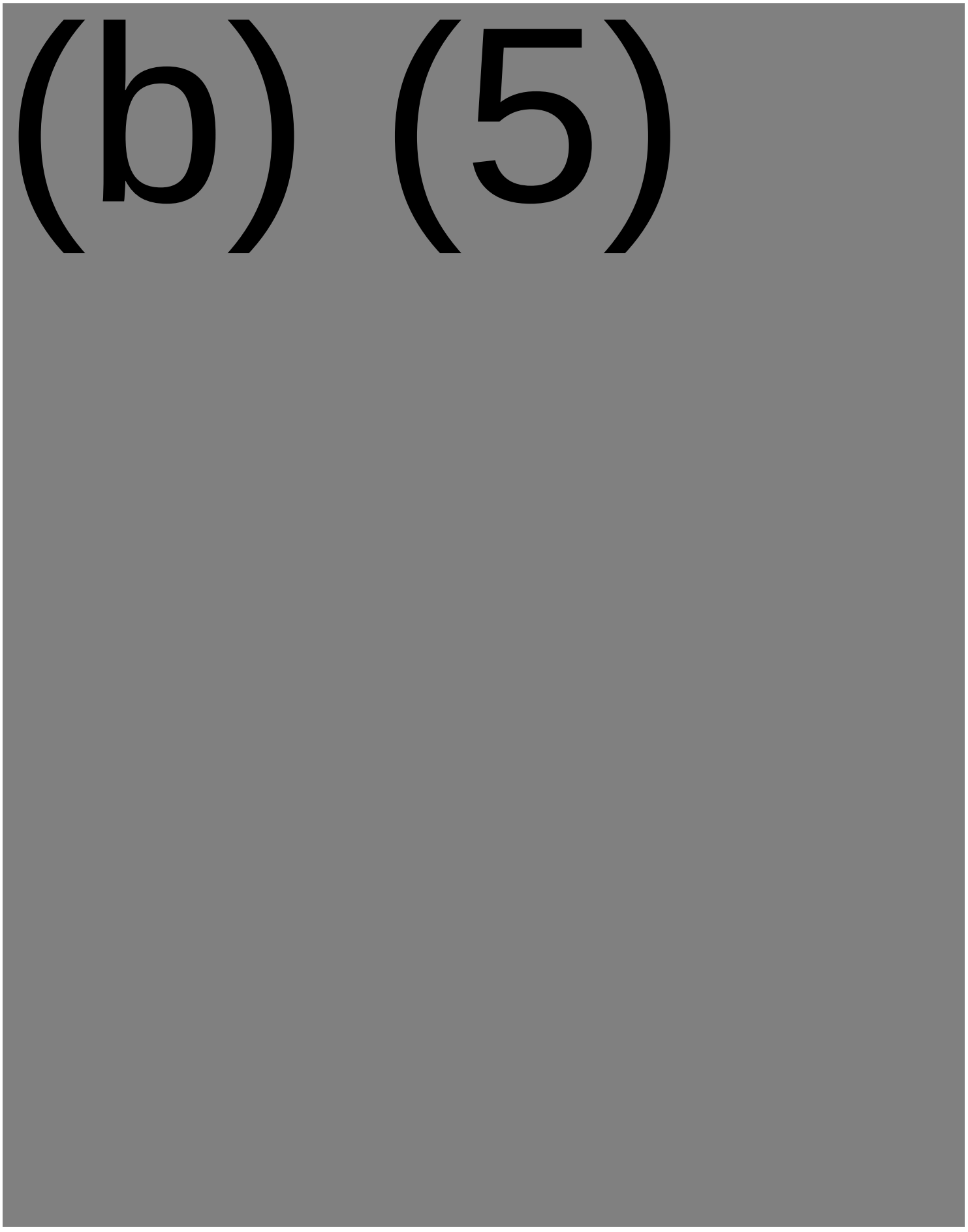
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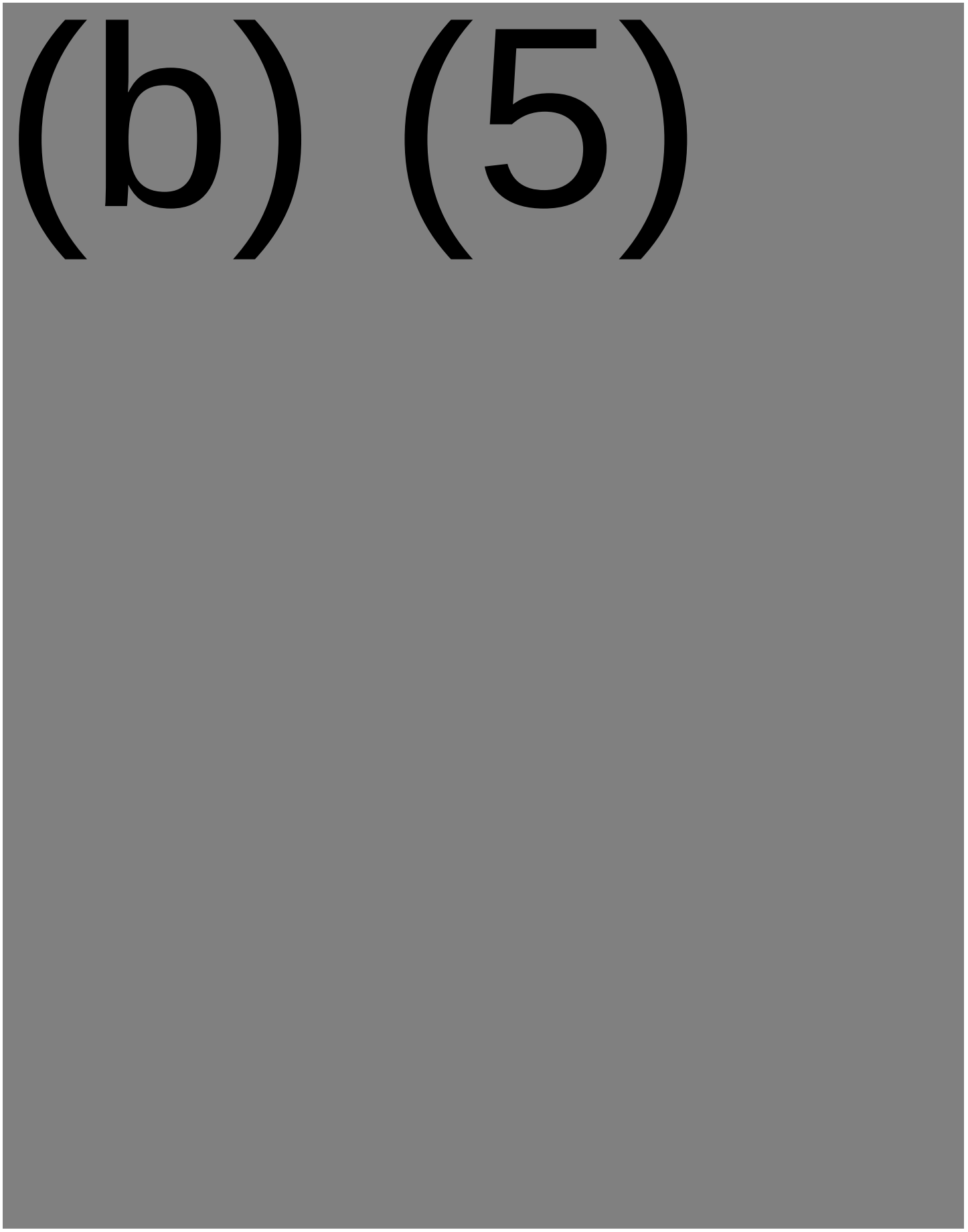
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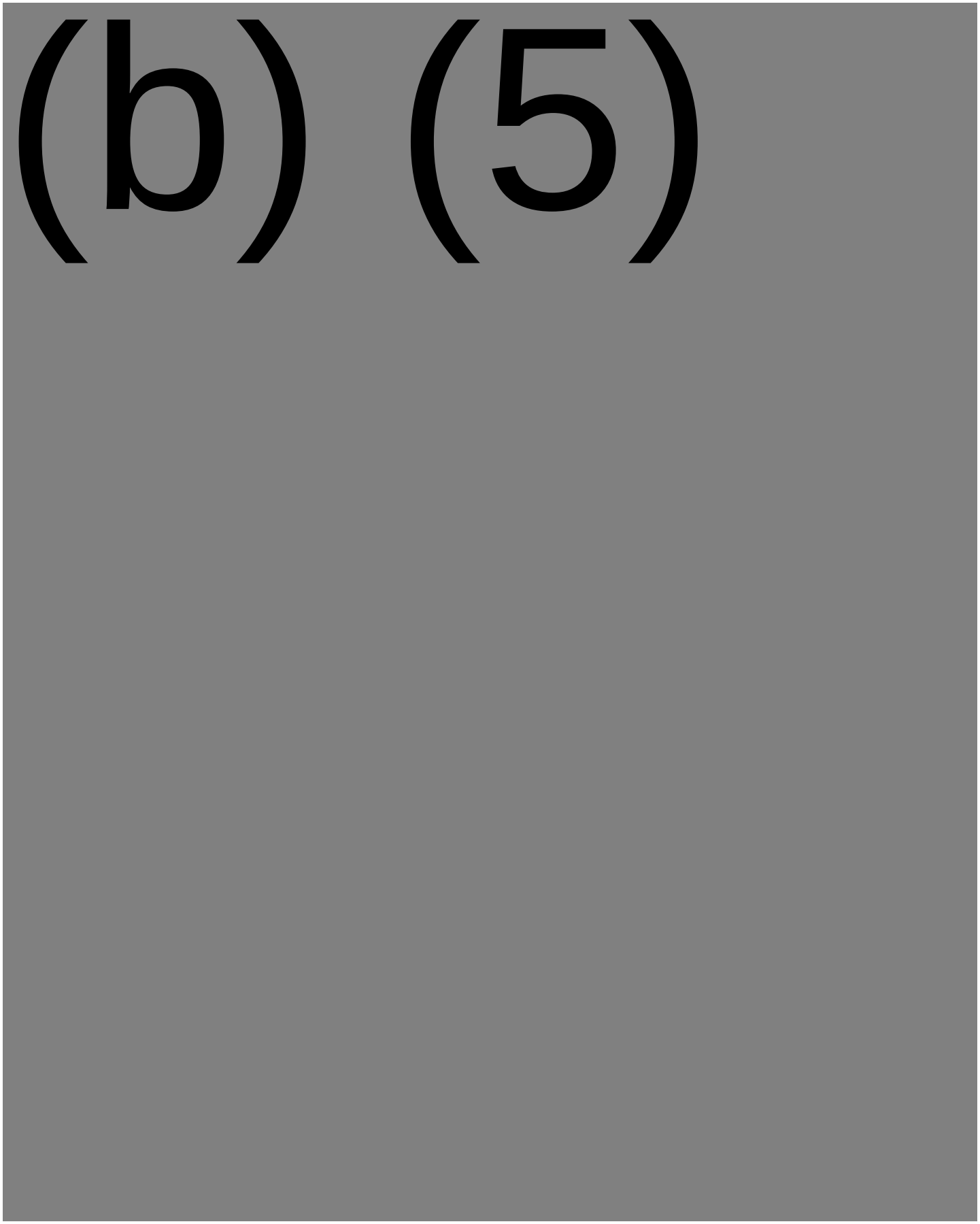
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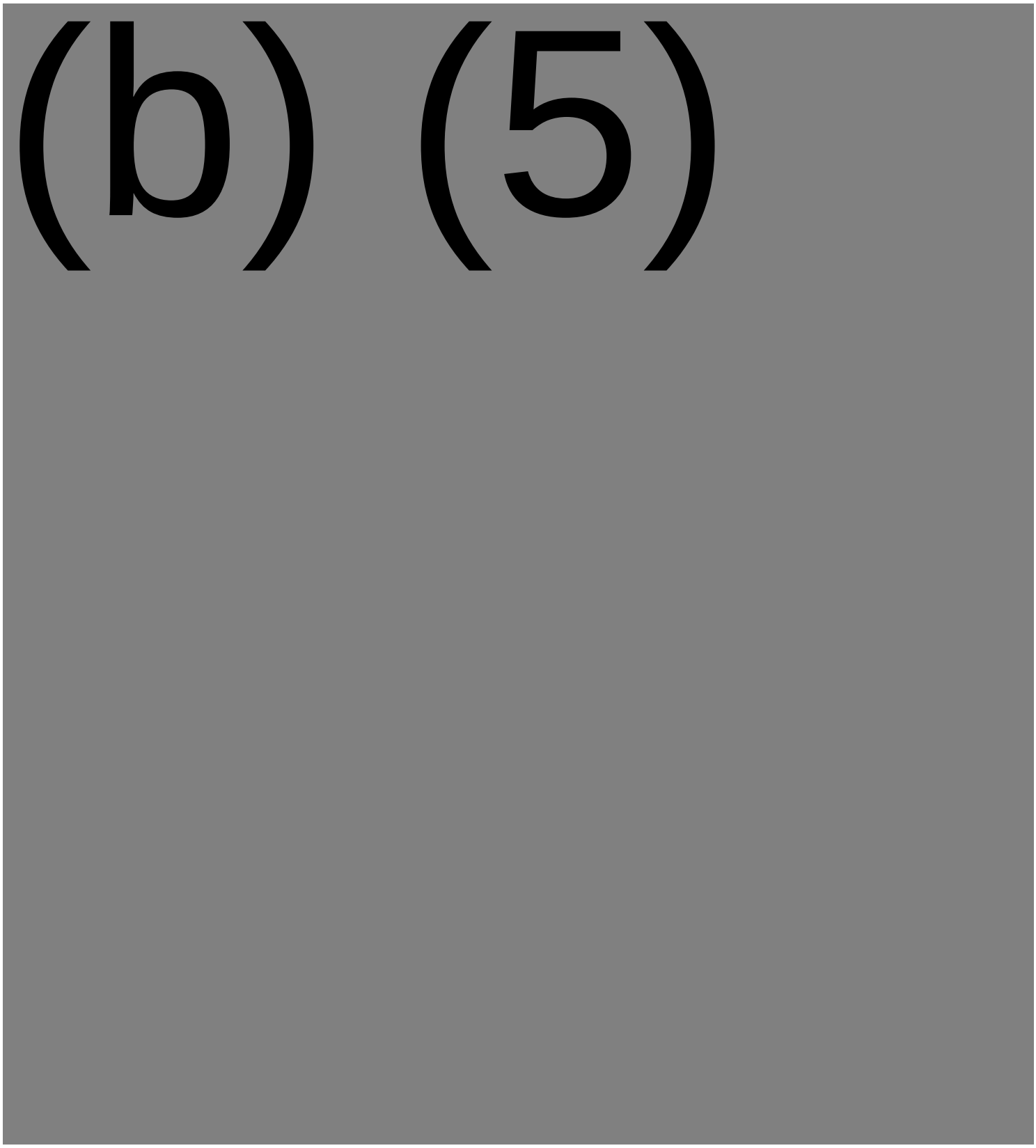
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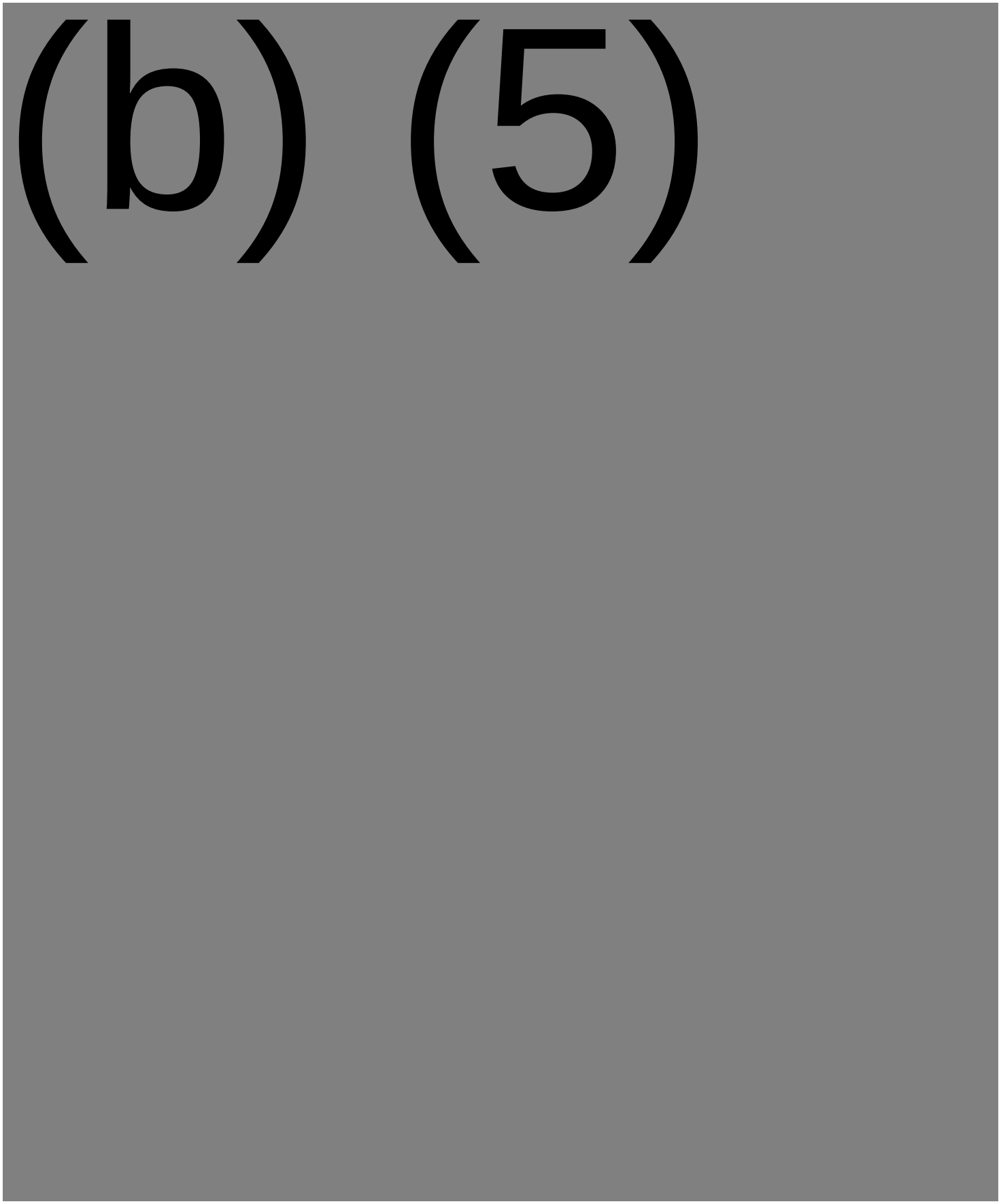
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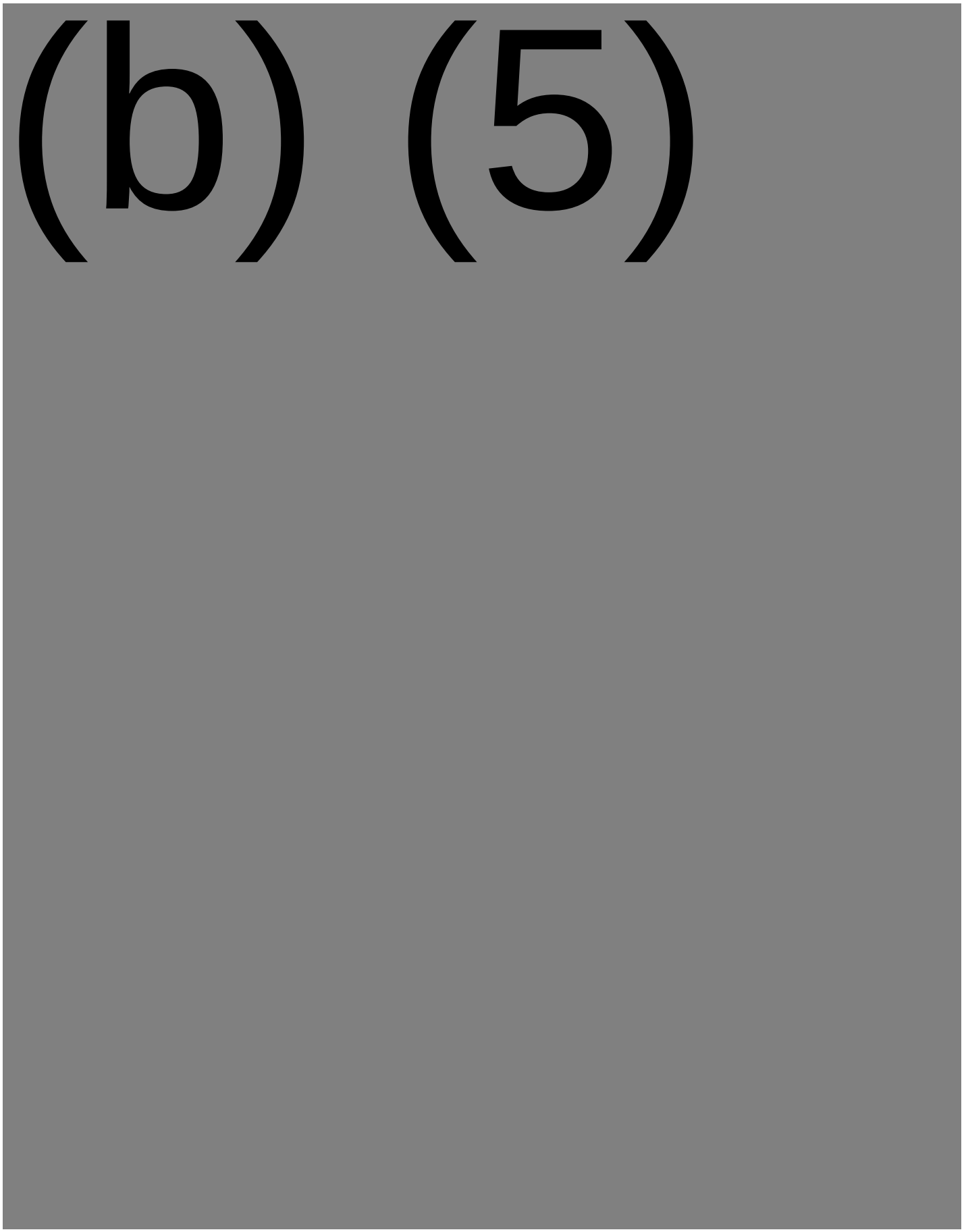
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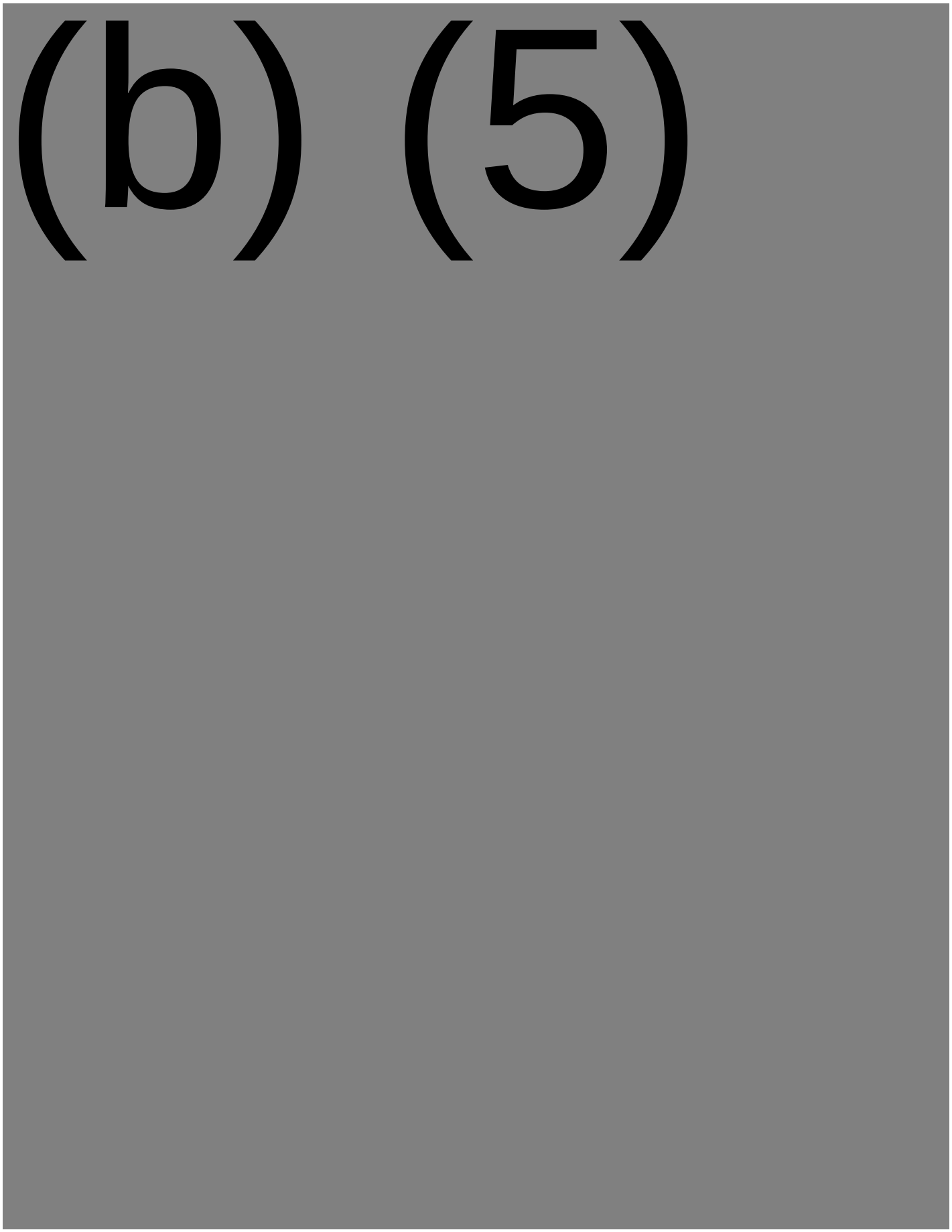
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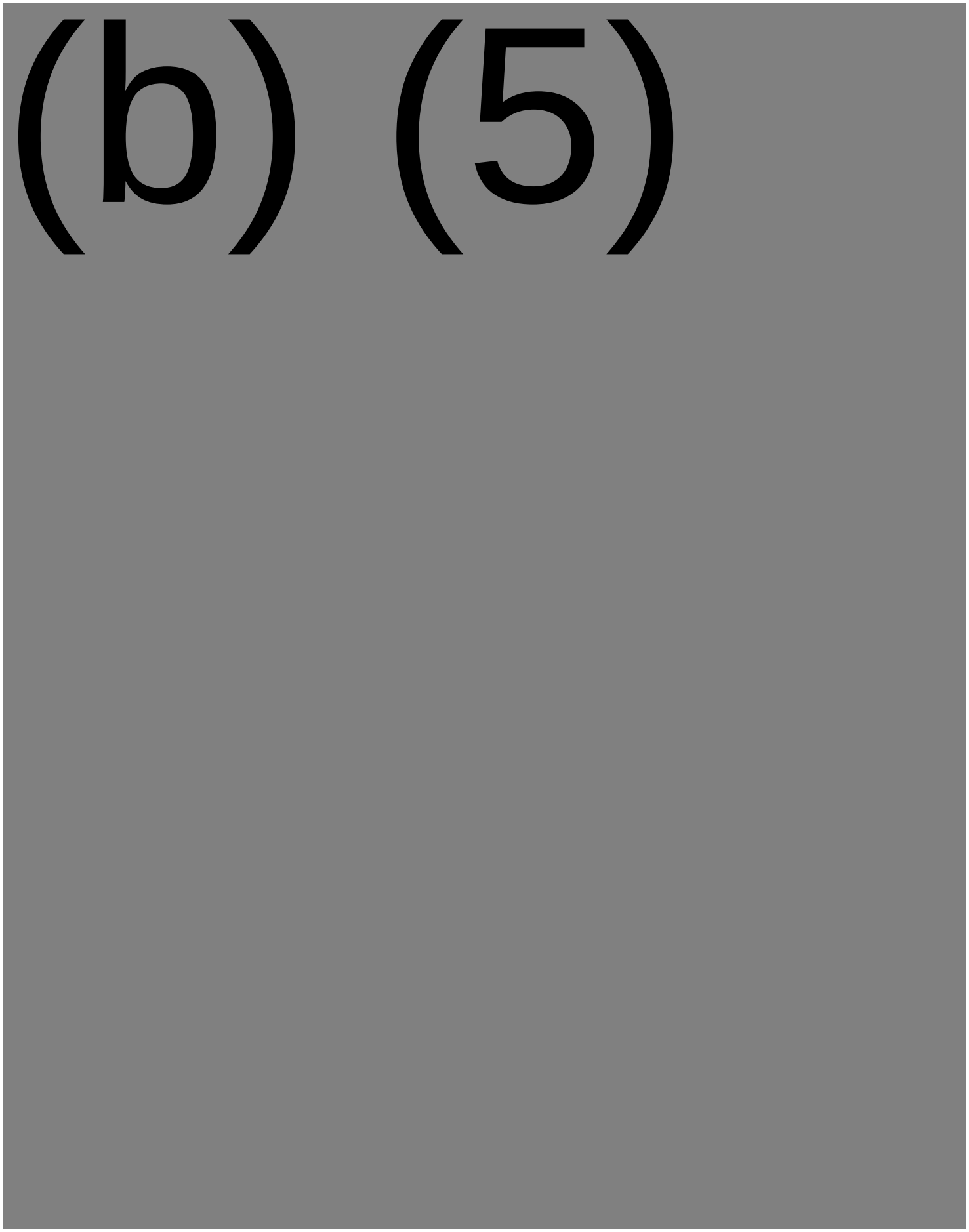
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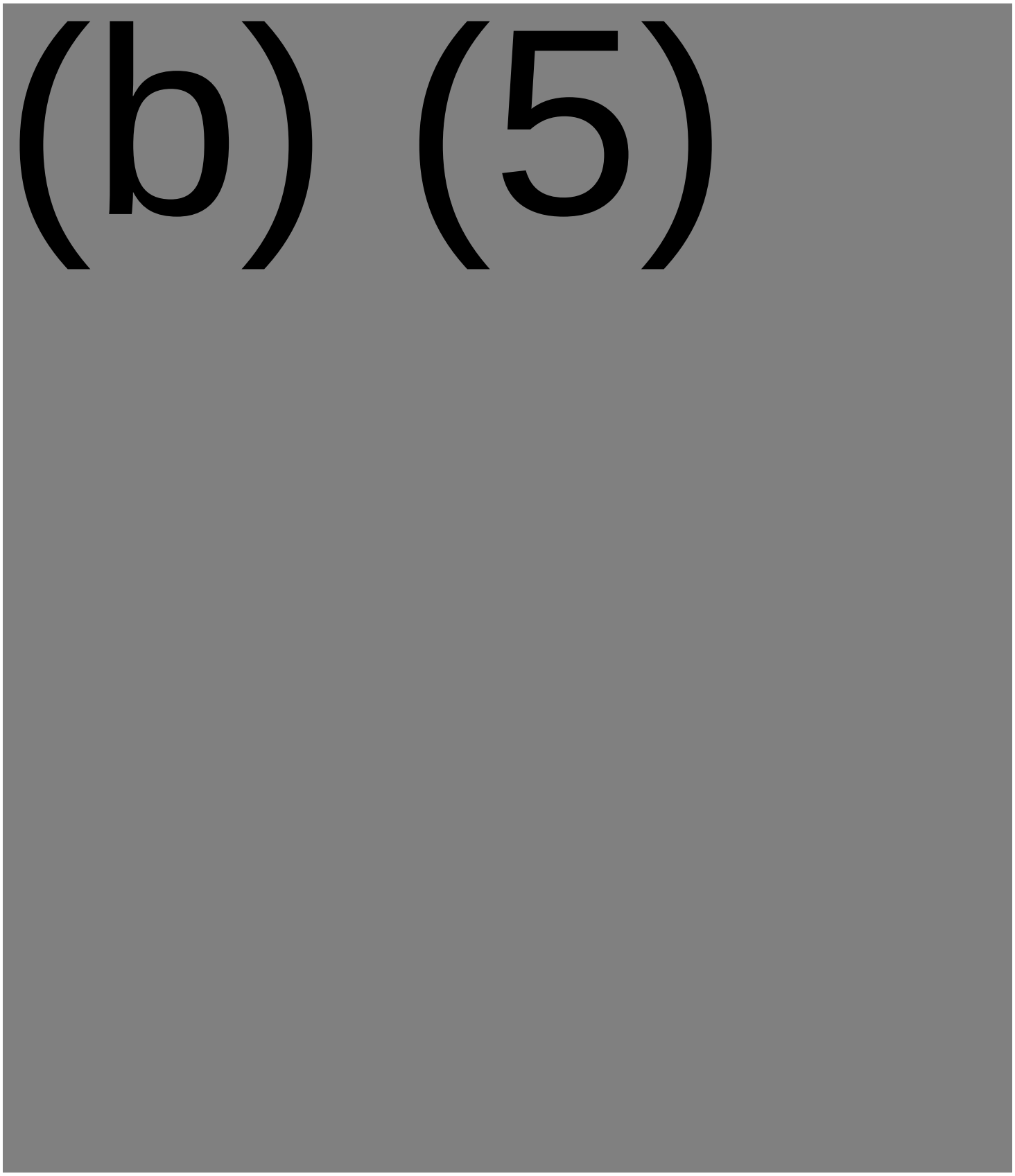
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(b) (5) - Tasks for Today - Agency Contacts

From: "Wilson, Matt B. EOP/OSTP" (b) (6)

To: "Watson, Ian D. EOP/OSTP" (b) (6), "Nichols, Lisa M. EOP/OSTP" (b) (6)

Cc: "Waterman, Paige E. EOP/OSTP" (b) (6), "Simon, Ian D. EOP/OSTP (Contractor)" (b) (6)

Date: Mon, 06 Apr 2020 07:58:39 -0400

Attachments: CV-19 (b) (5)
(b) (5)

Hi Ian and Lisa,

Good morning. (b) (5)

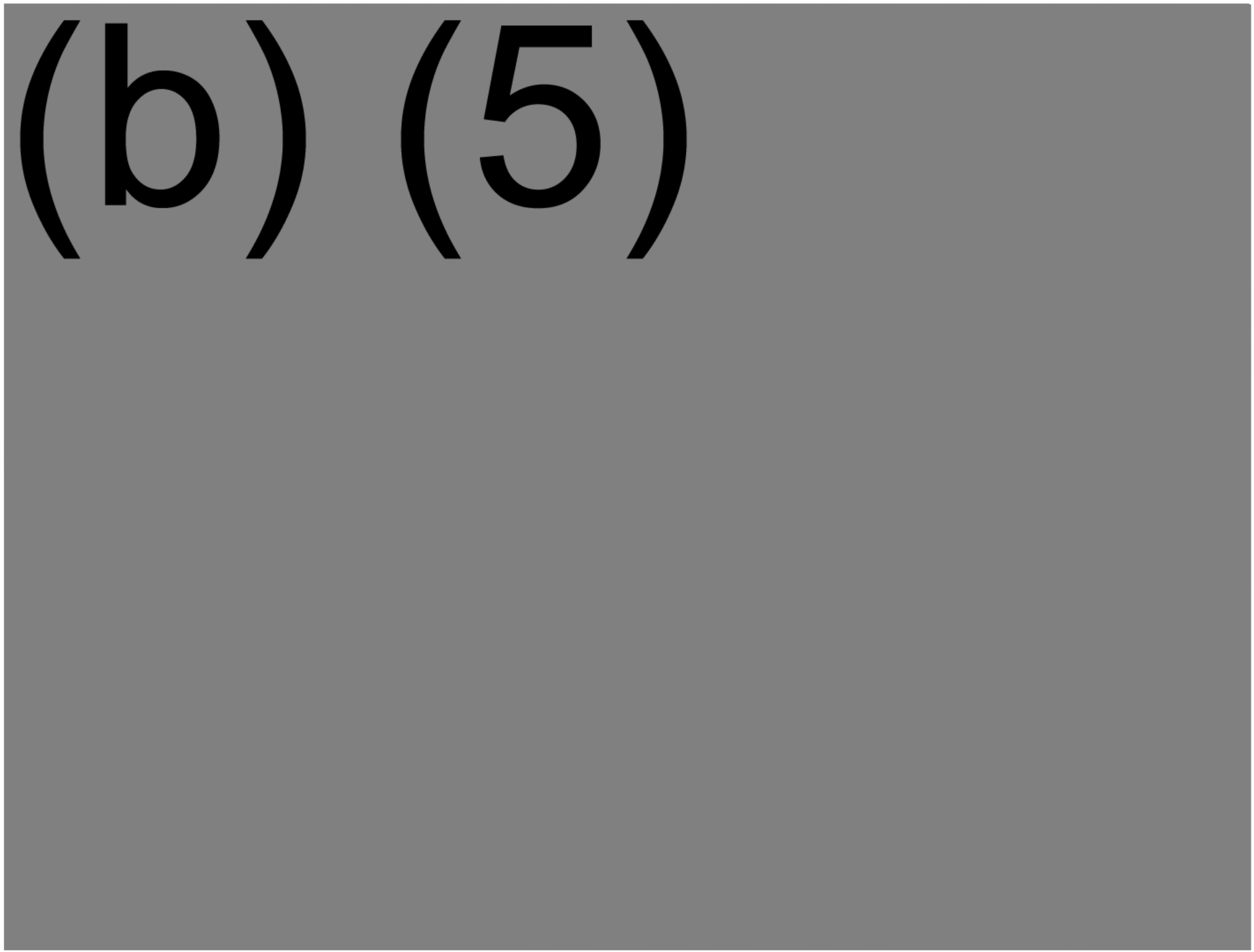
(b) (5)

Lisa, (b) (5)

(b) (5)

Matt

Matthew B. Wilson, PhD
Principal Assistant Director
Office of Science and Technology Policy
Executive Office of the President
1650 Pennsylvania Avenue, NW
Washington, DC 20502
Office: (b) (6)
Mobile: (b) (6)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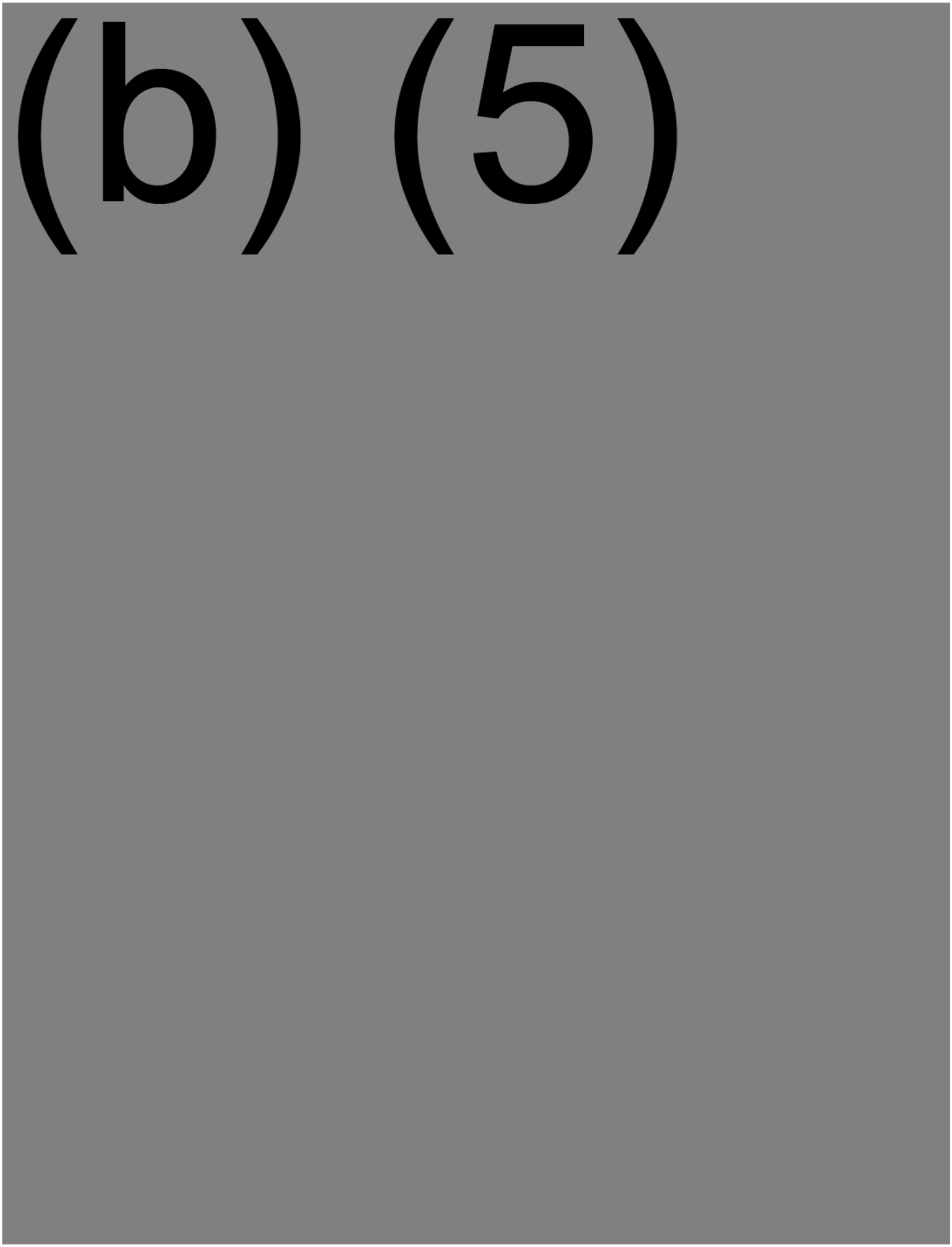
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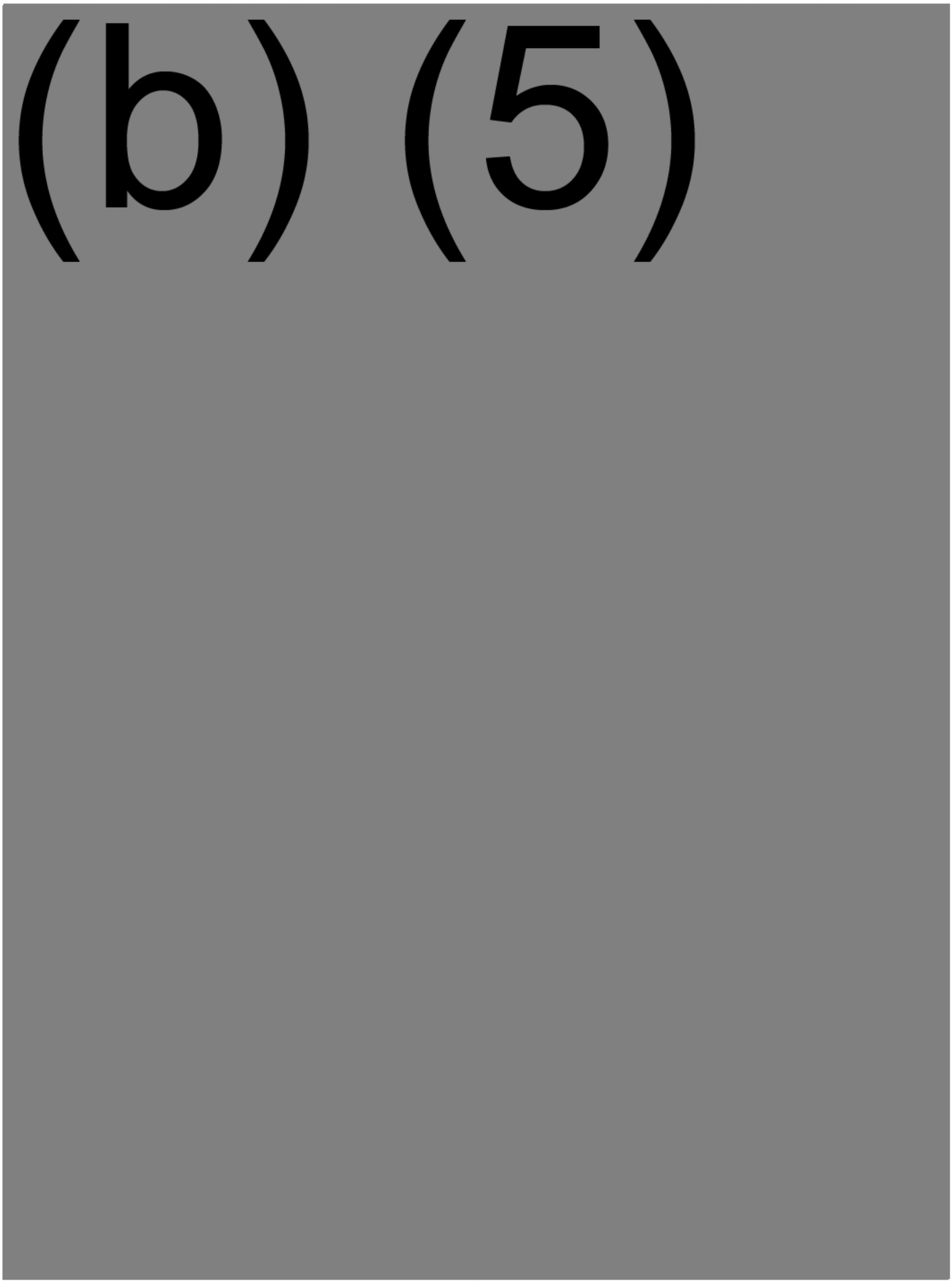
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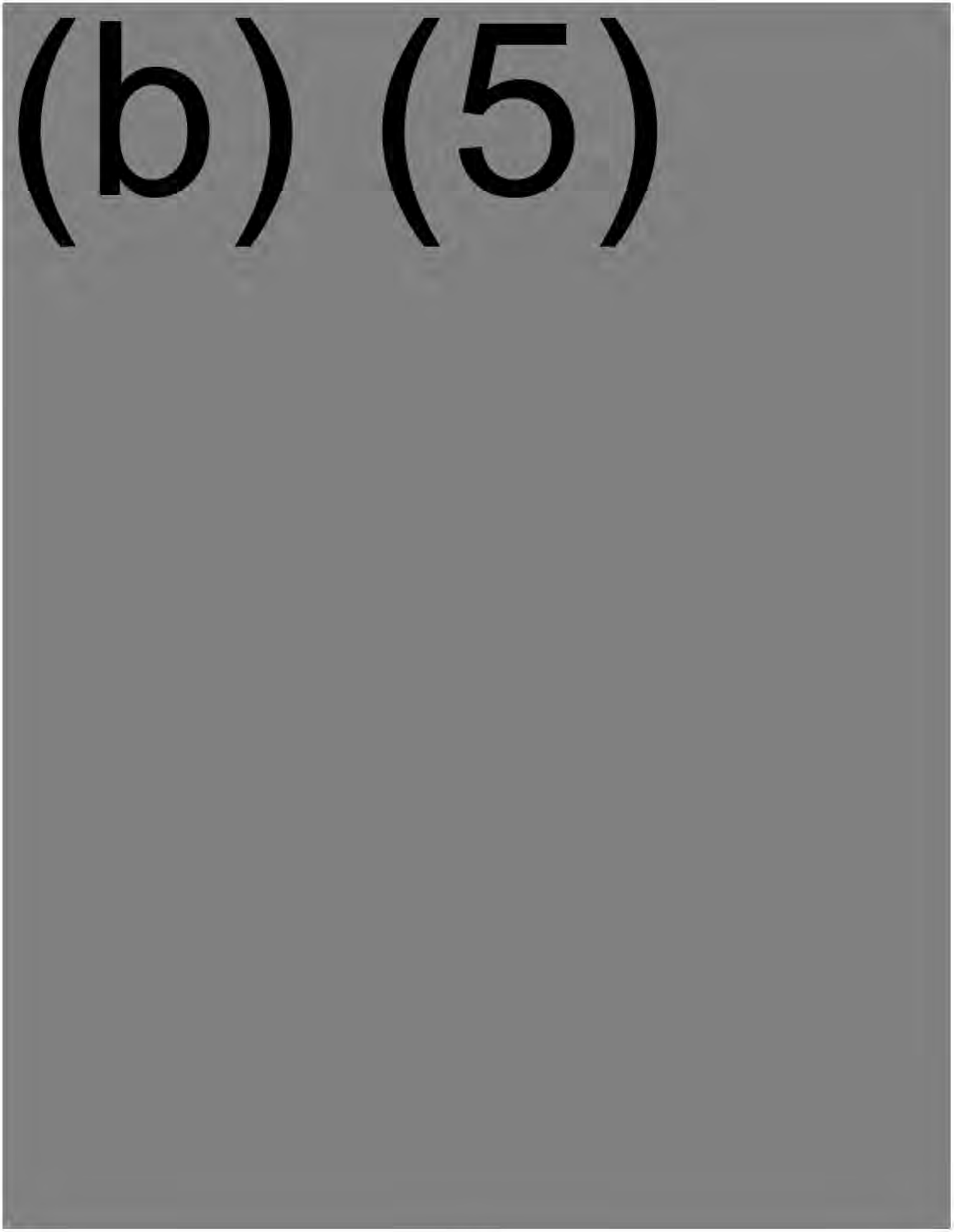
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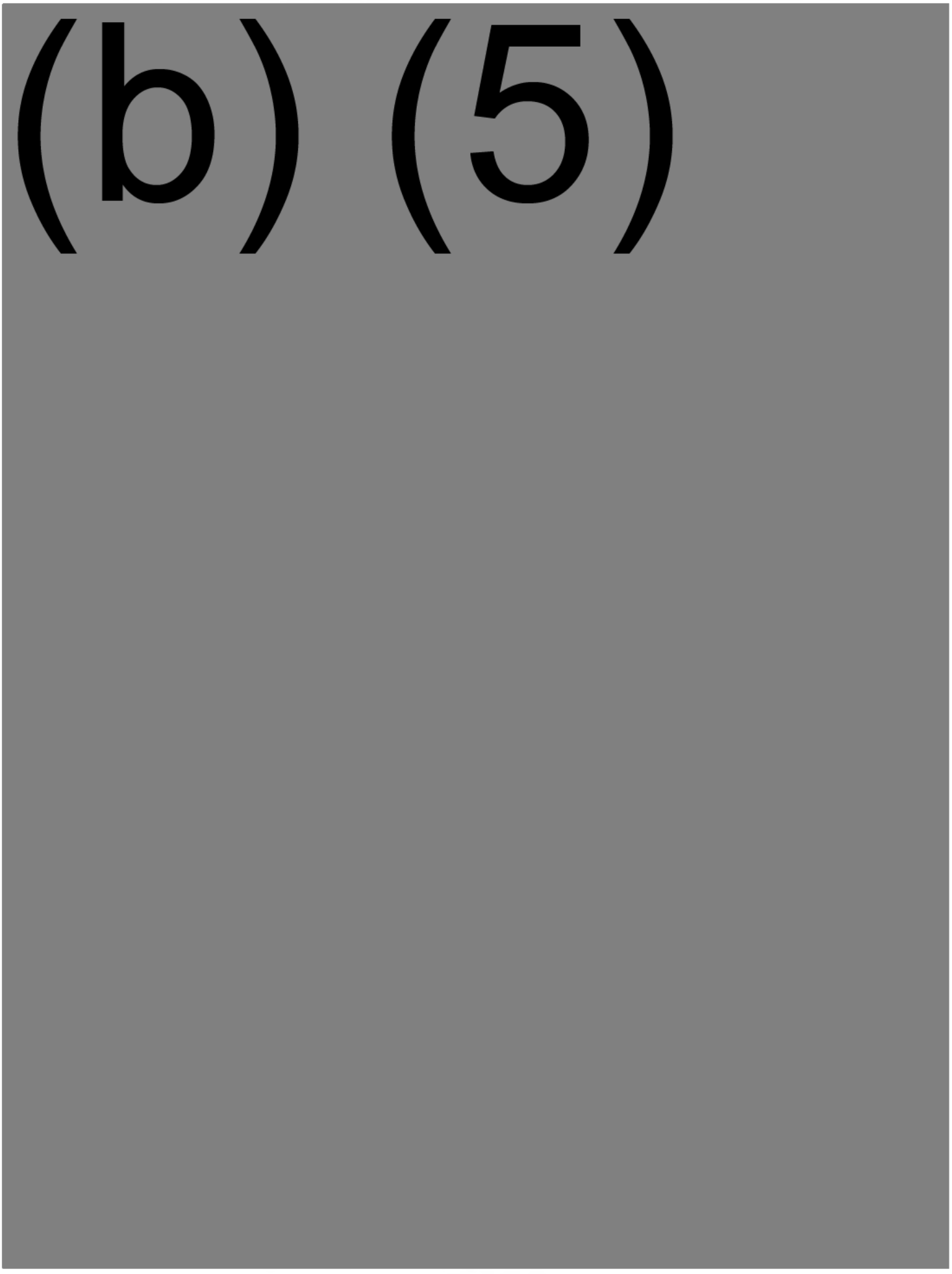
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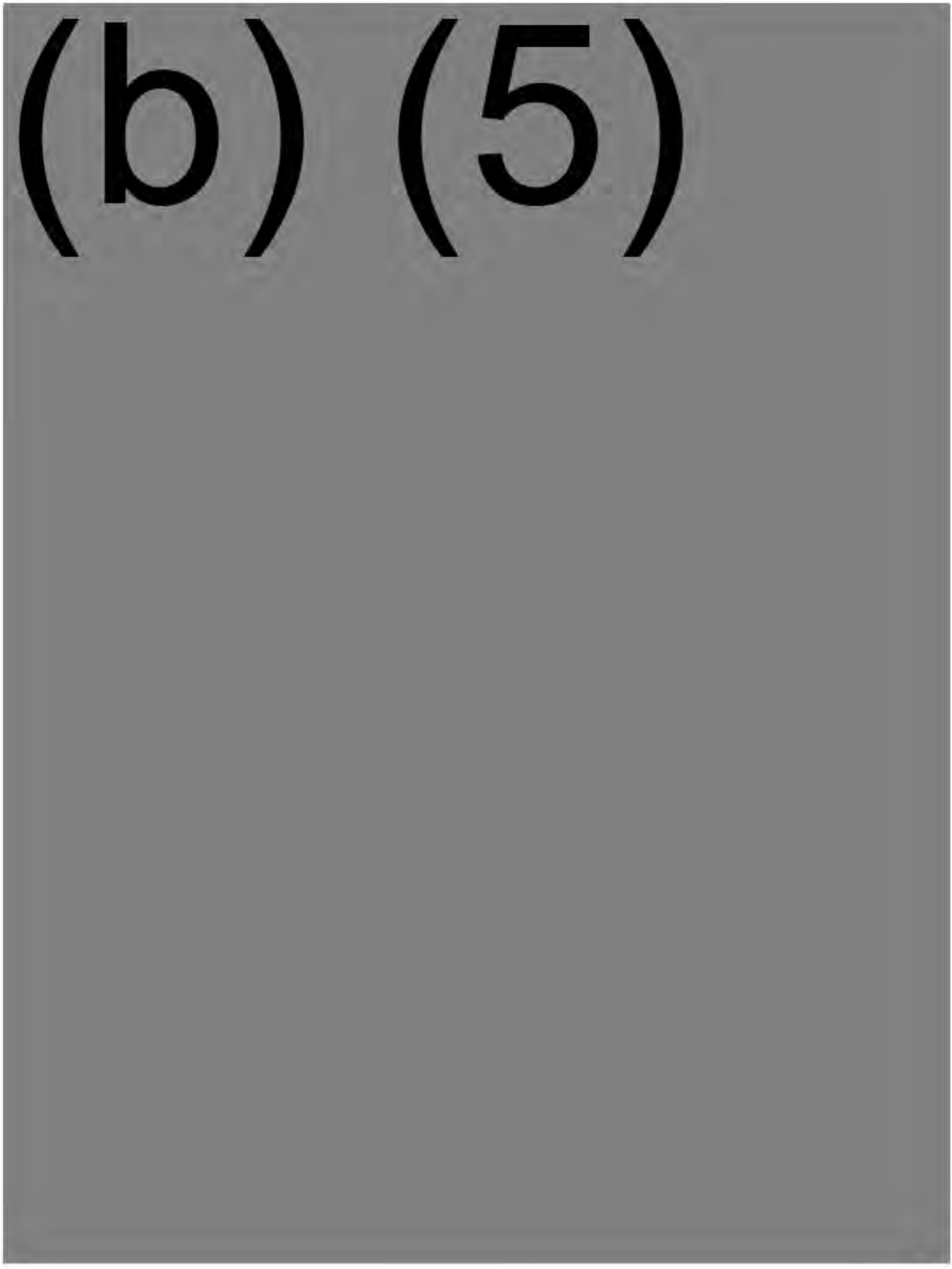
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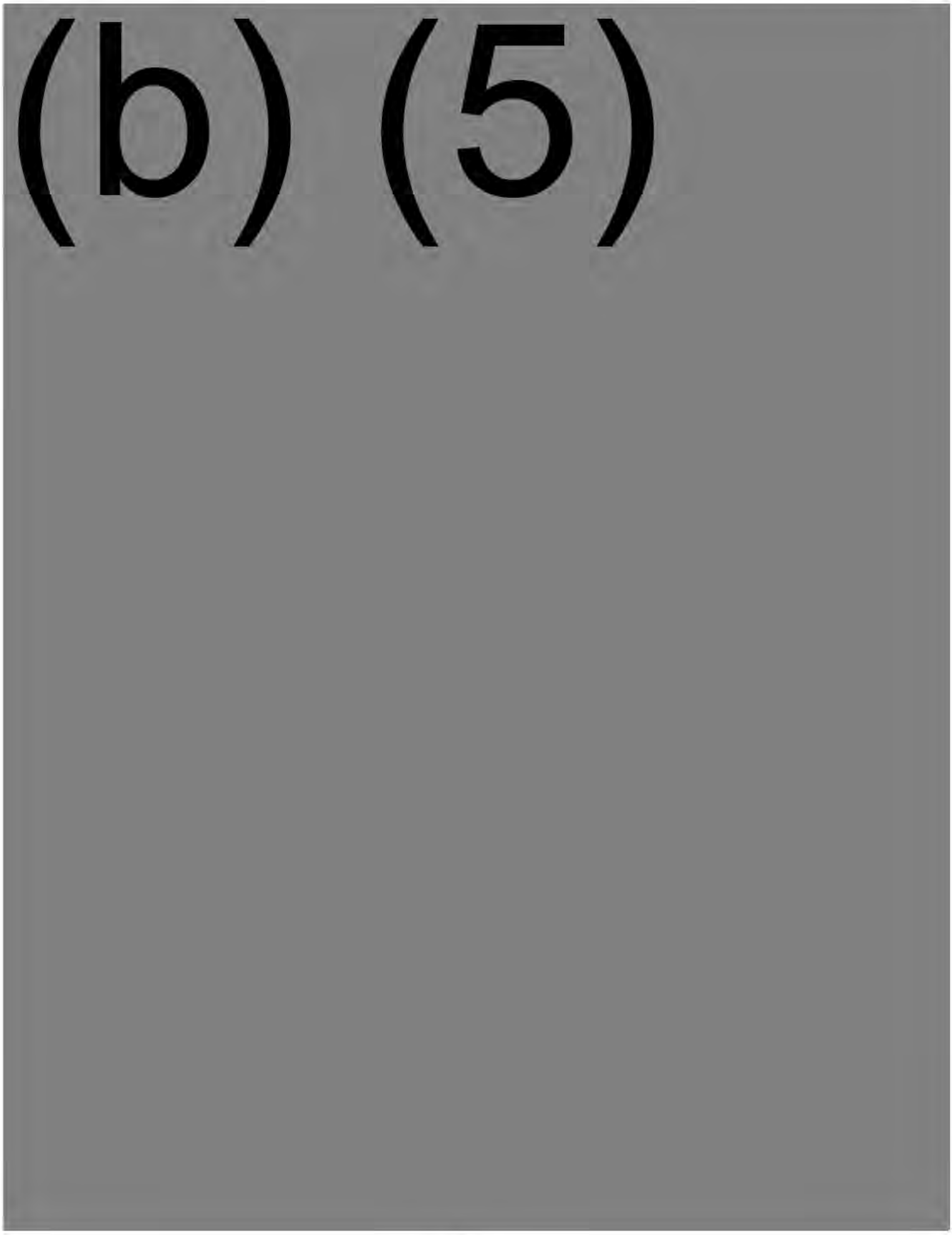
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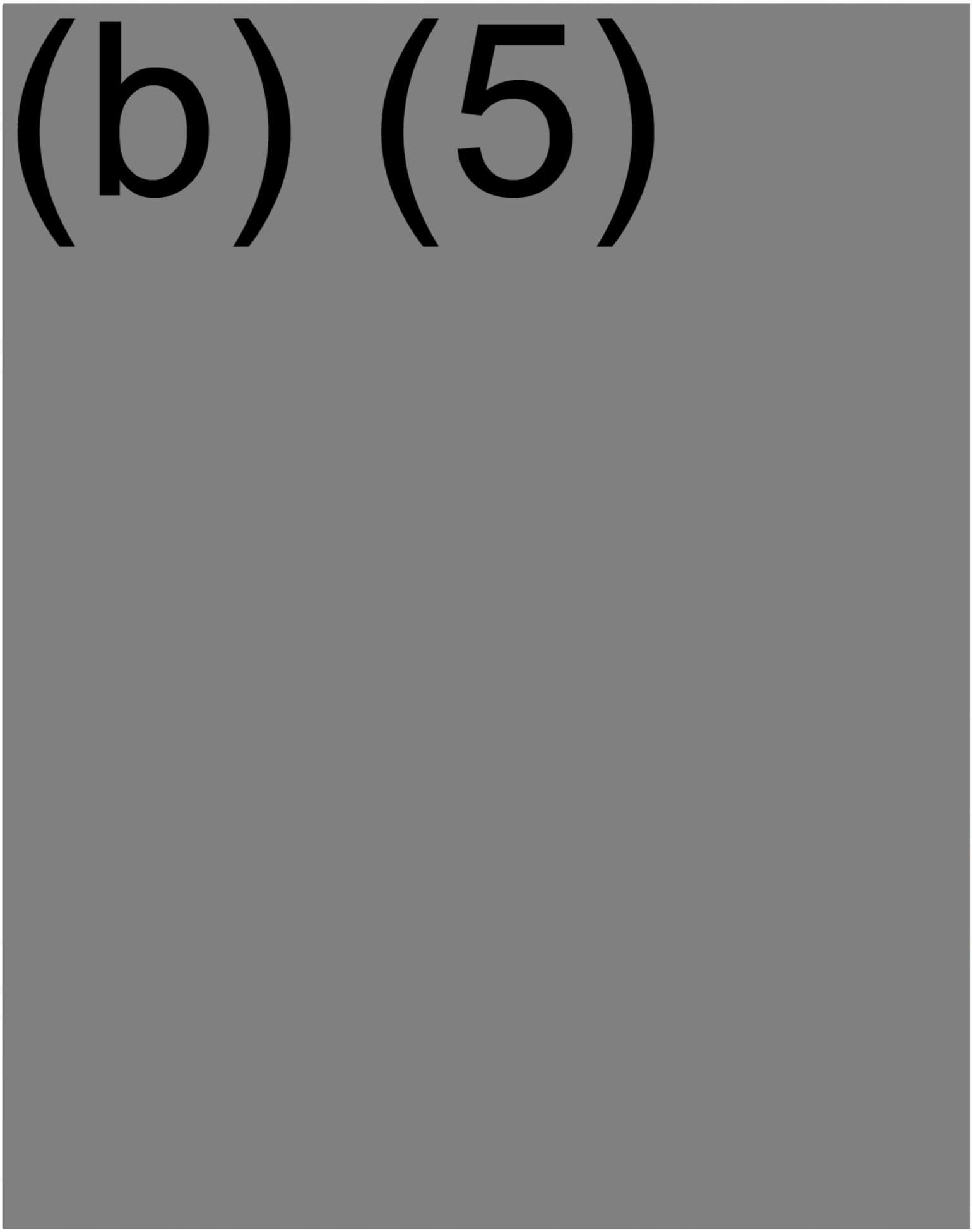

(b) (5)

Dynamic Analytics

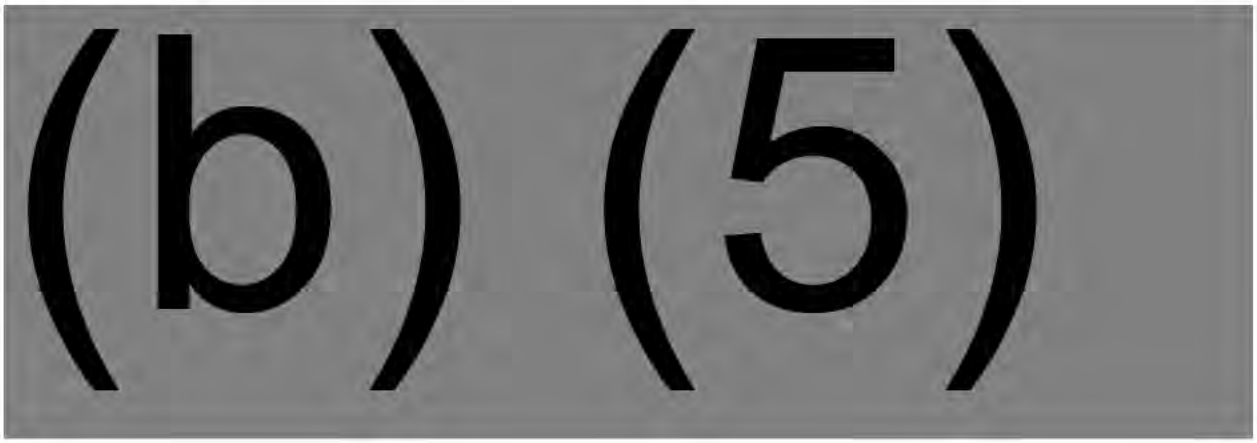
From: "Lattimore, Tracie B. EOP/OSTP" (b) (6)

To: "Waterman, Paige E. EOP/OSTP" (b) (6) "Vythilingam, Meena (HHS/OASH)" (b) (6) "Kilianski, Andrew CIV OSD OUSD POLICY (USA)" (b) (6), (b) (6) "Ritter, Benjamin R LTC USARMY HQDA DCS G-1 (USA)" (b) (6), "Koehlmoos, Tracey" (b) (6) "Barker, Adam" (b) (6), "Vaughan, Christopher" (b) (6) "Shankman, Rob (OS/ASPR/SIIM)" (b) (6)>, "Mall, Tehmina" (b) (6) (b) (6), "Hann, Todd A CIV DTRA R AND D (US)" (b) (6) "Carr, Garrett H MAJ USARMY HQDA DCS G-8 (USA)" (b) (6) "Tisdel, Sara L CIV DTRA OI (USA)" (b) (6) "Kramlich, Gary R COL USARMY DTRA OI (USA)" (b) (6), "Smith, Amanda" (b) (6) (b) (6)

Date: Tue, 07 Apr 2020 11:49:51 -0400

Attachments: Dynamic Analytics 7 APR 2020.pptx (12.71 MB); COVID19 (b) (5)

Team,
Thank you for the input this morning. (b) (5)



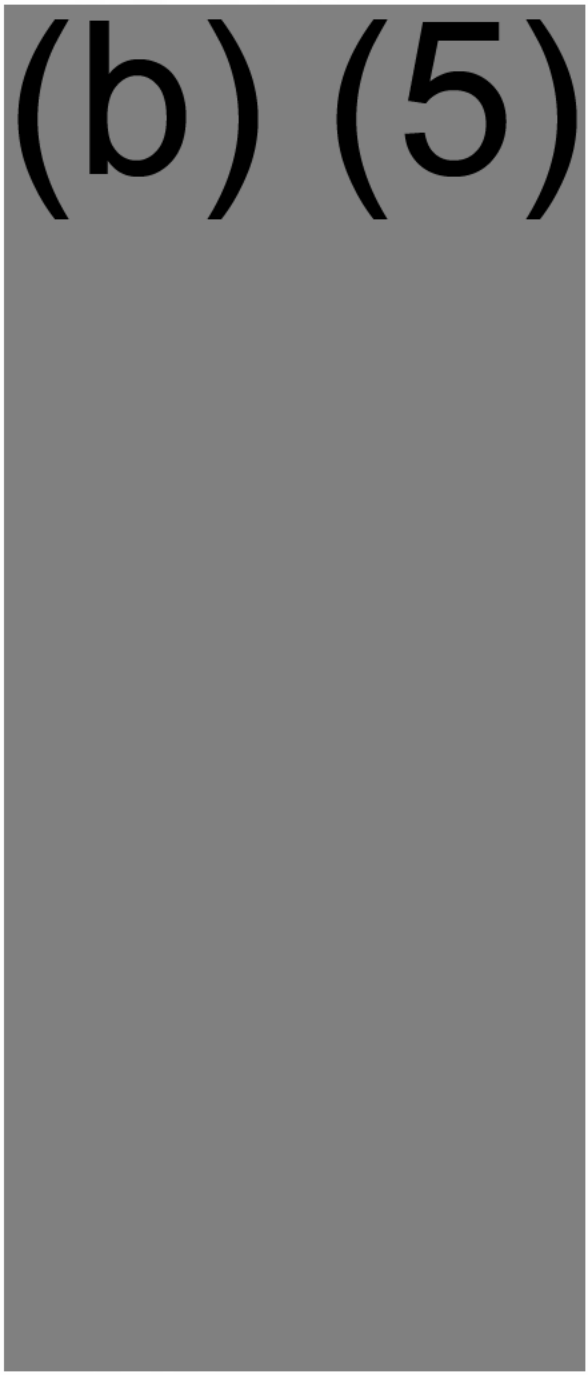
(b) (5)

Chris Vaughn,
Please add all on the to line to the FEMA COP access.

I appreciate all the work!

Best, tracie

Tracie Lattimore
Senior Policy Advisor
Executive Office of the President
Office of Science and Technology Policy
(O) (b) (6)
(M) (b) (6)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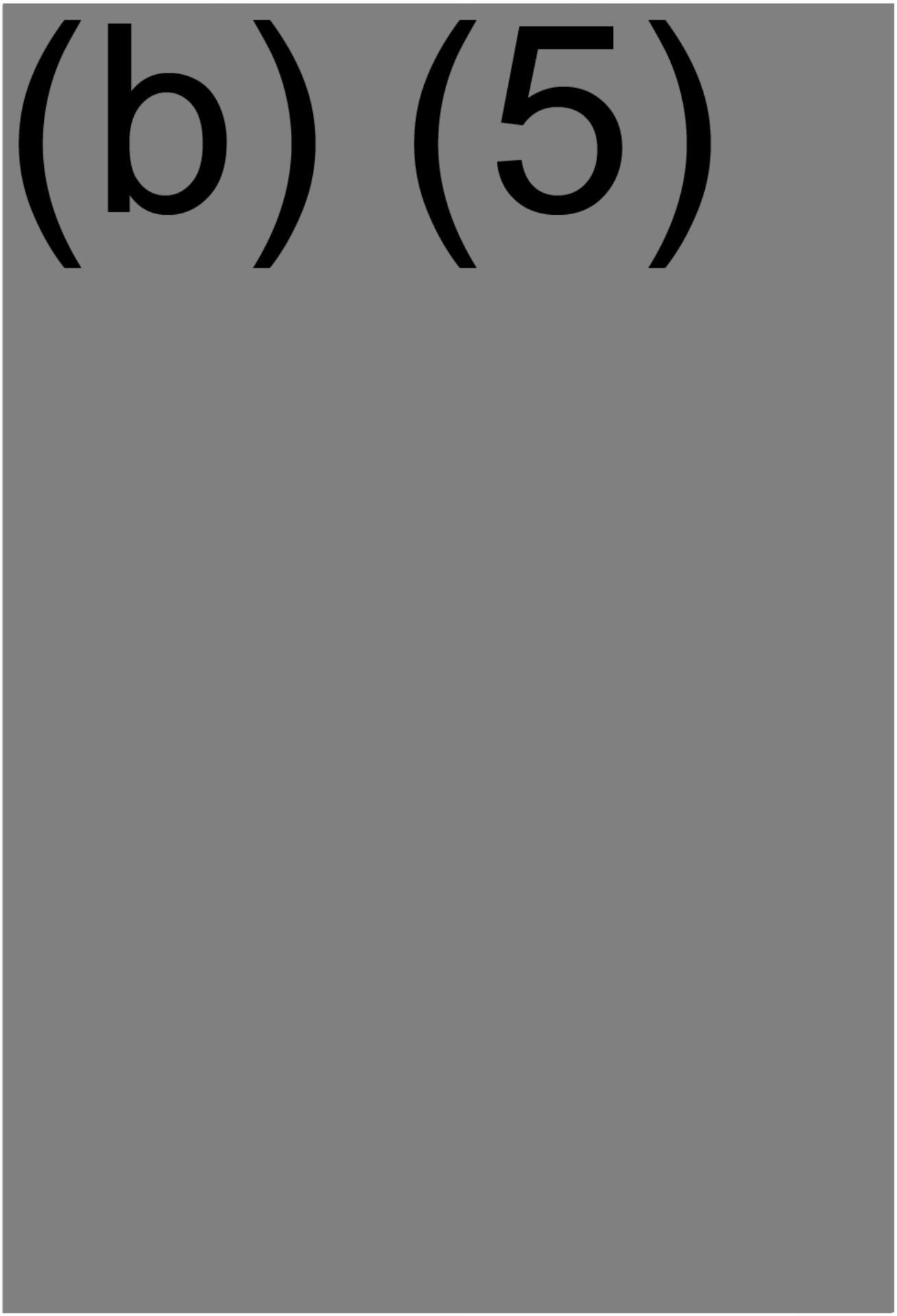
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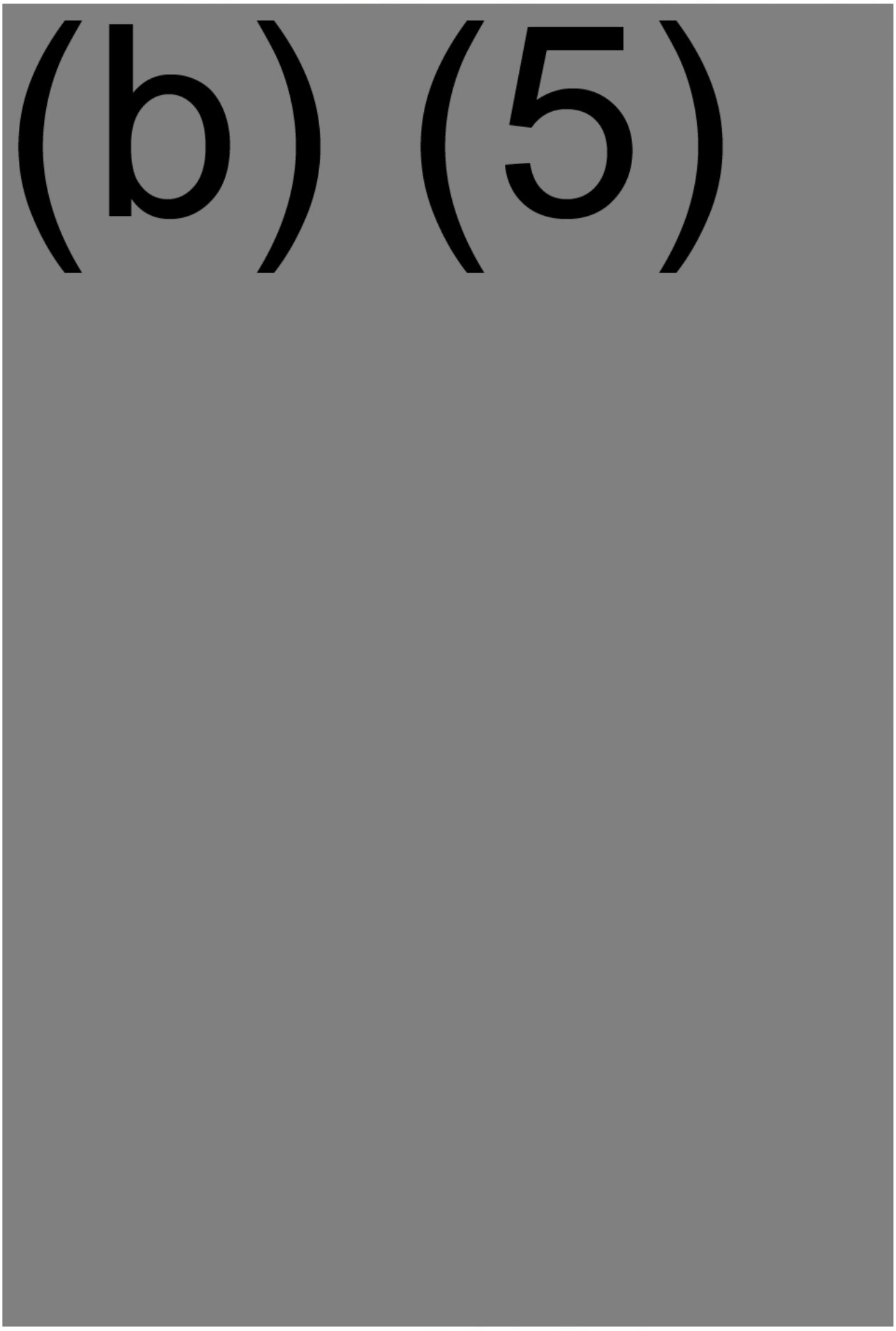
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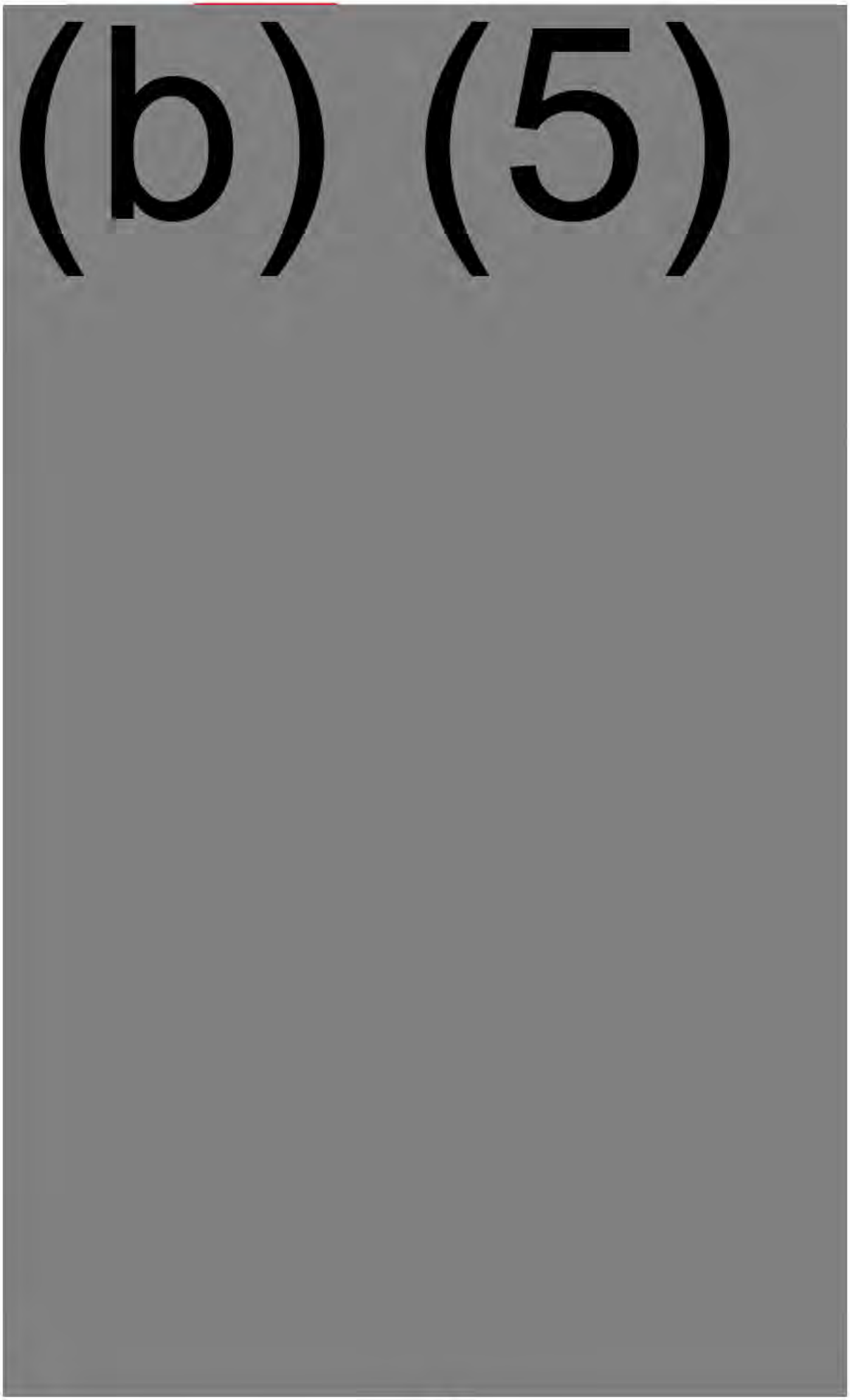
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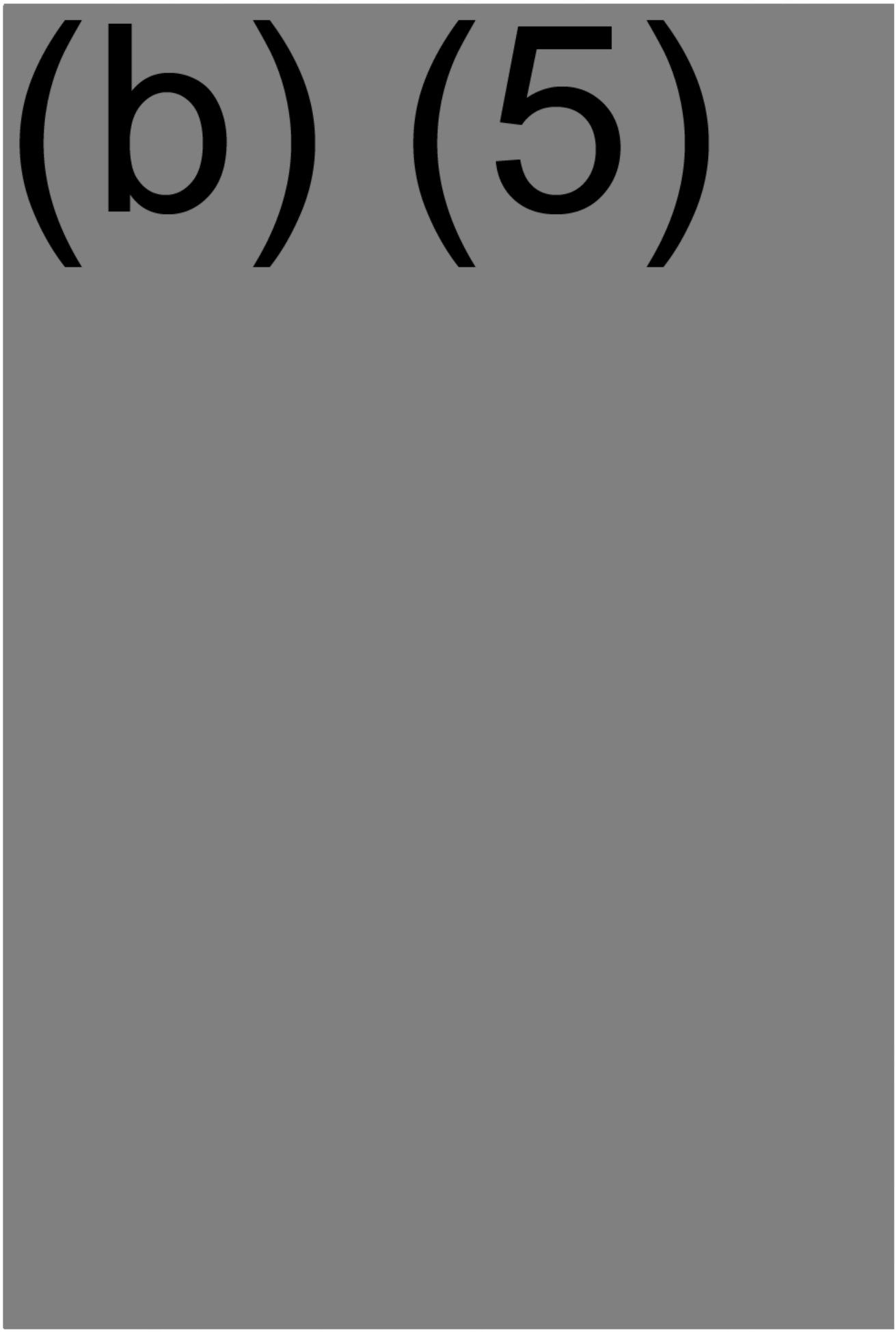
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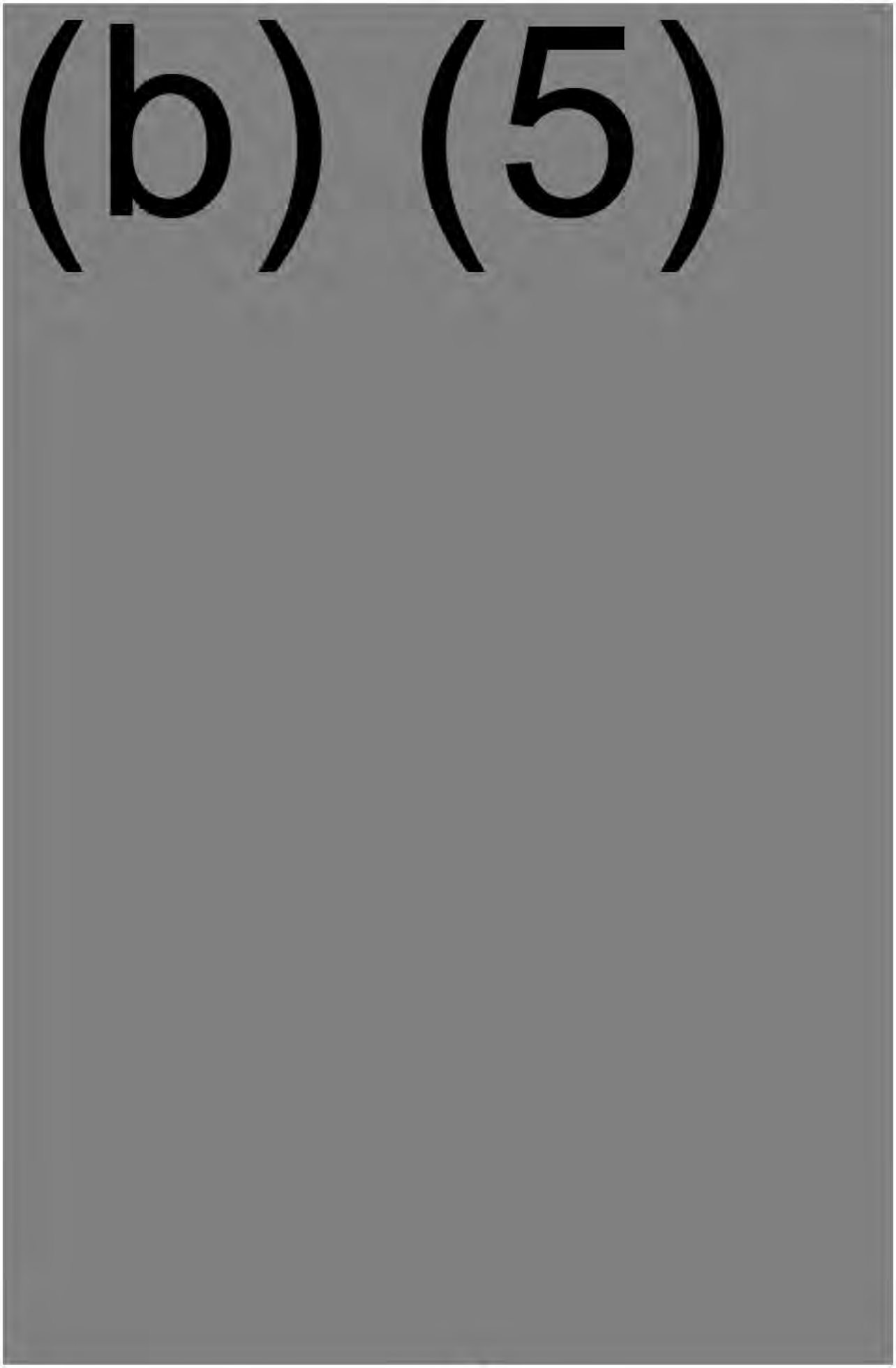
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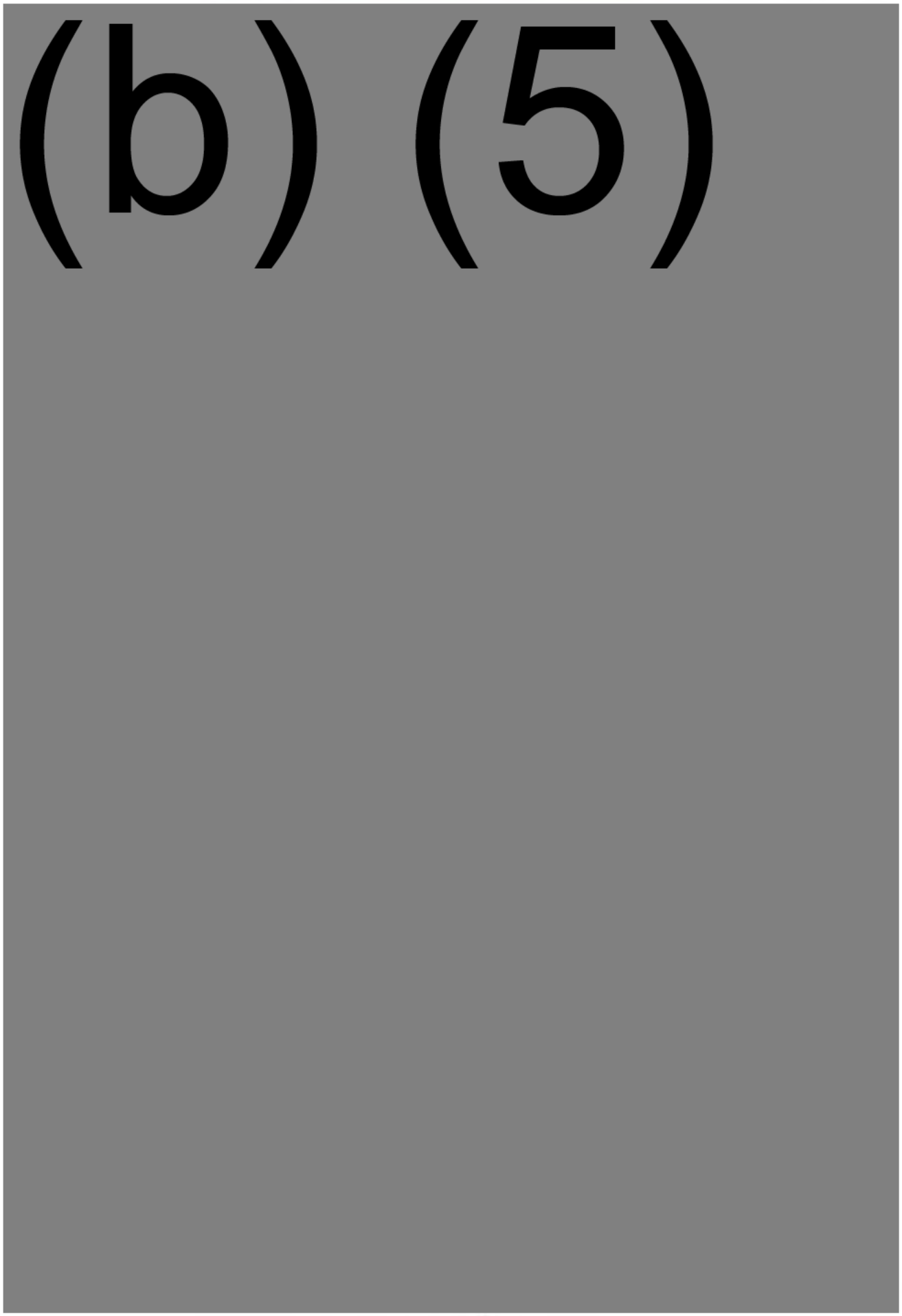
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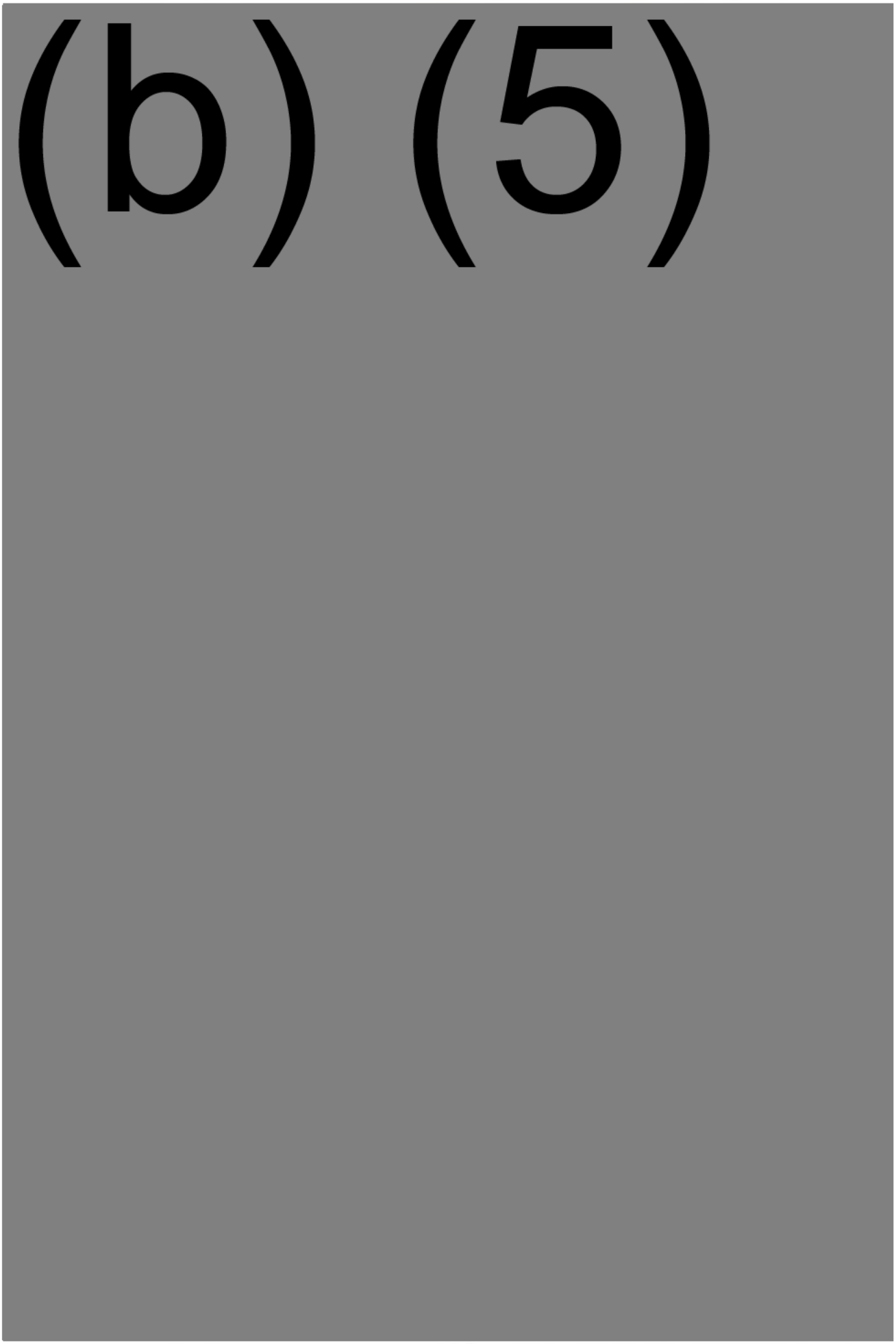
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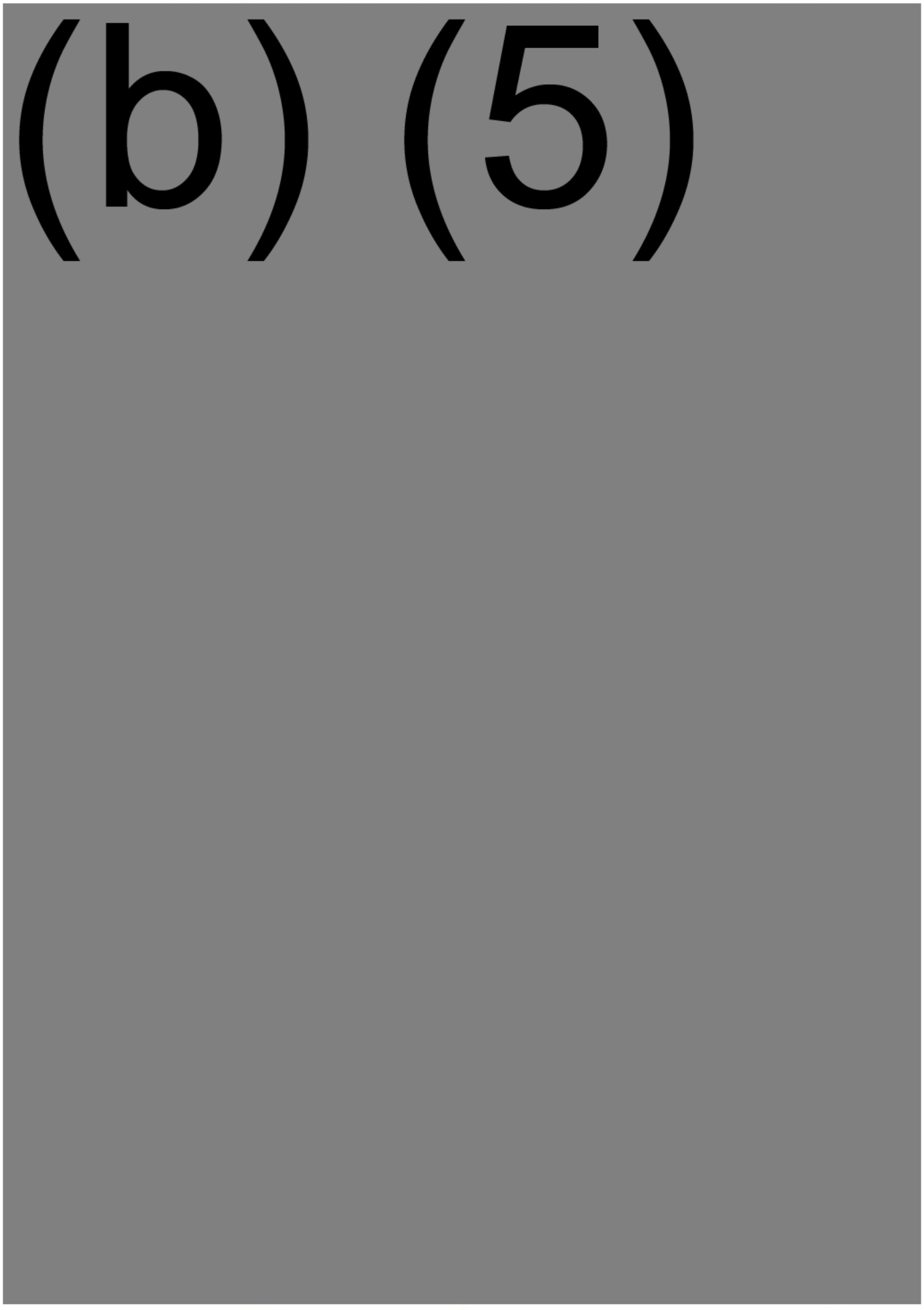
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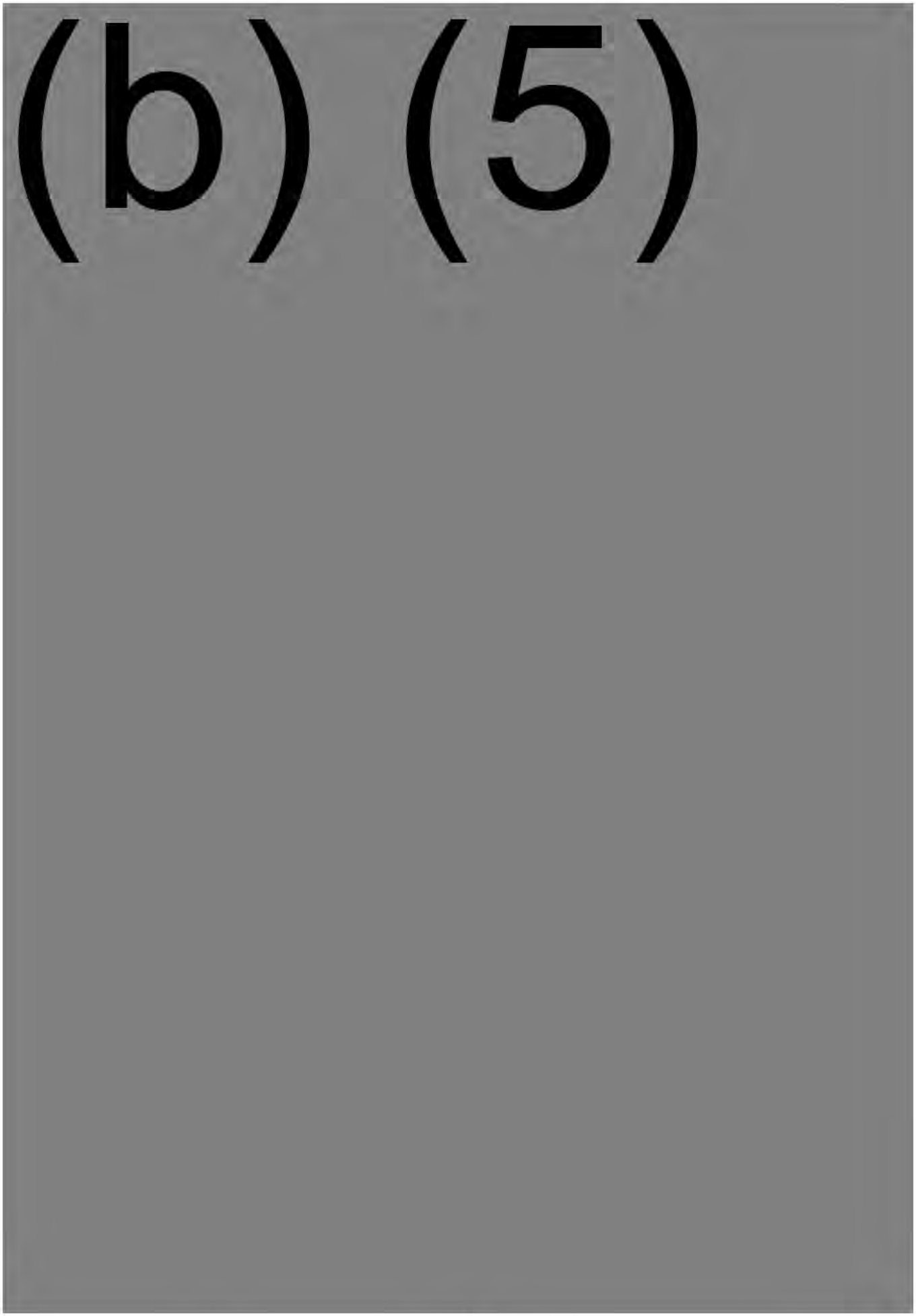
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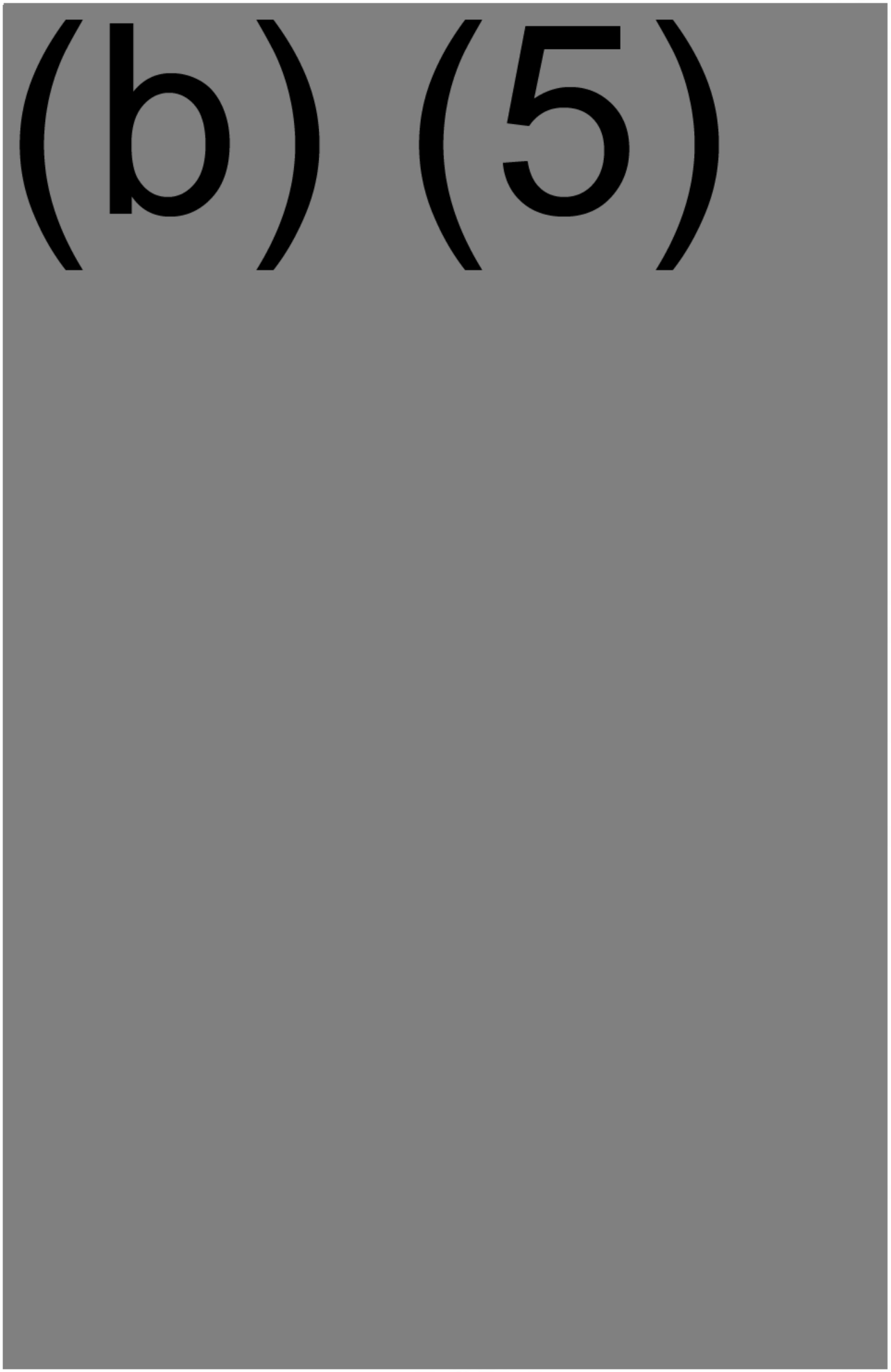
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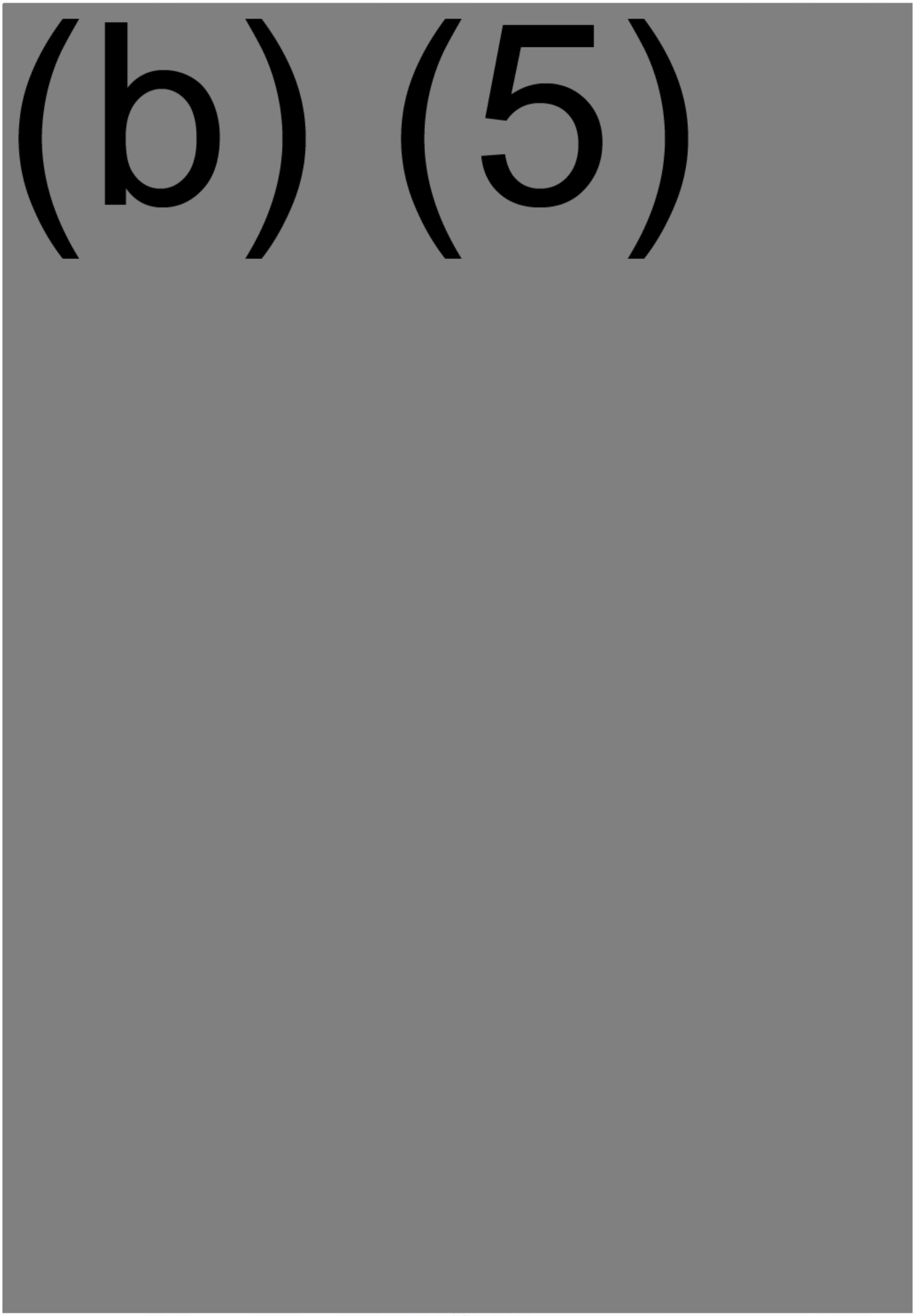
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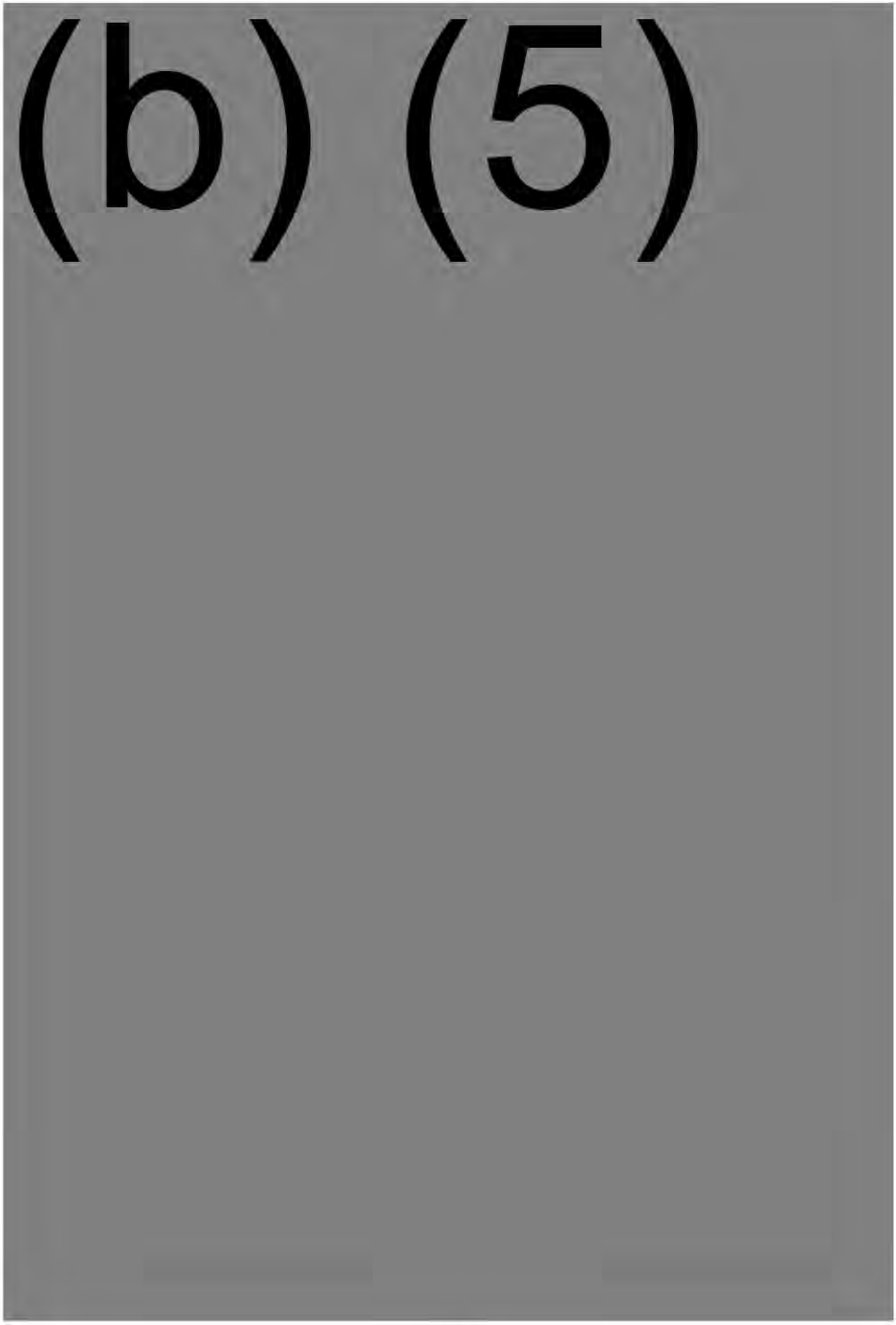
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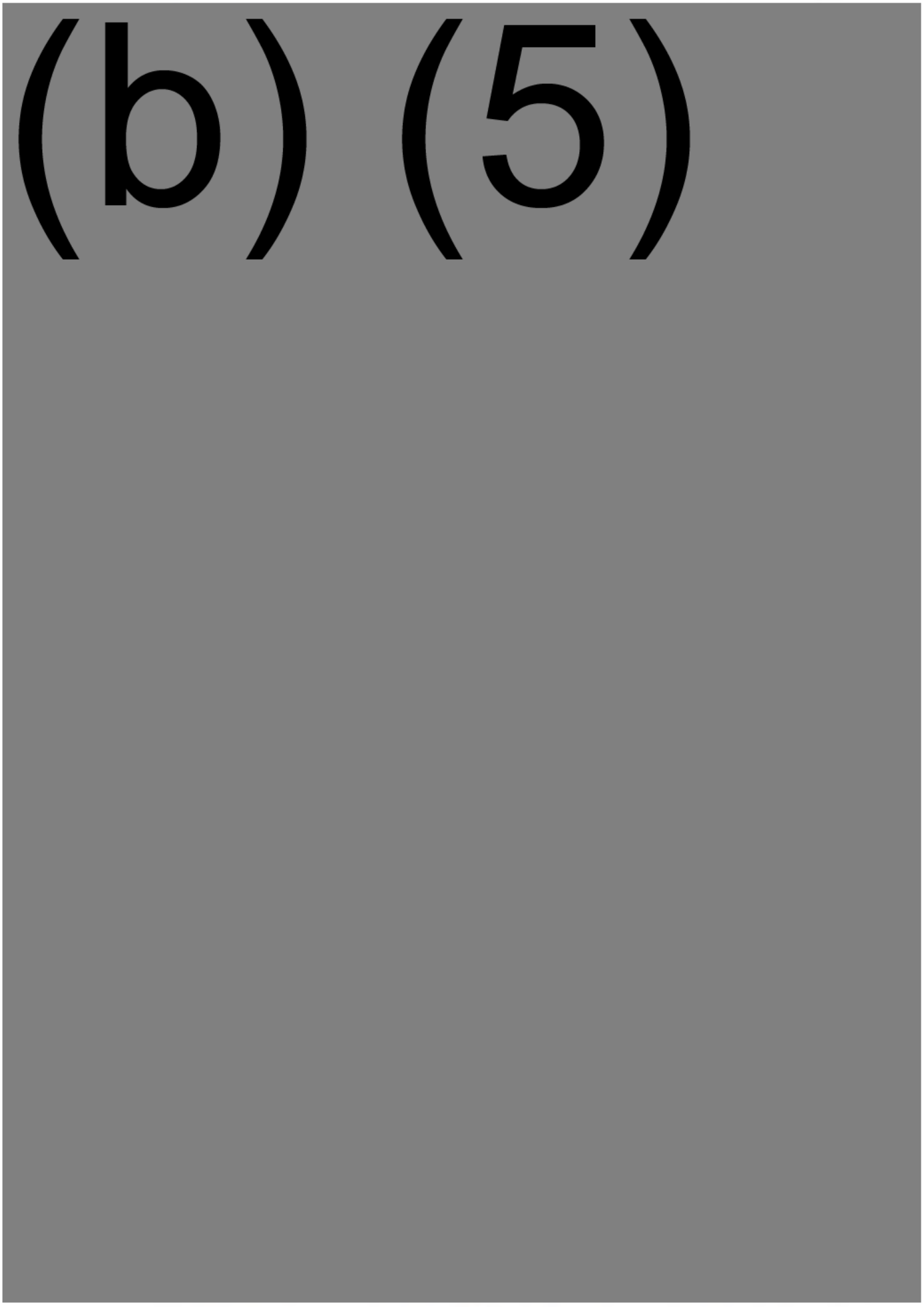
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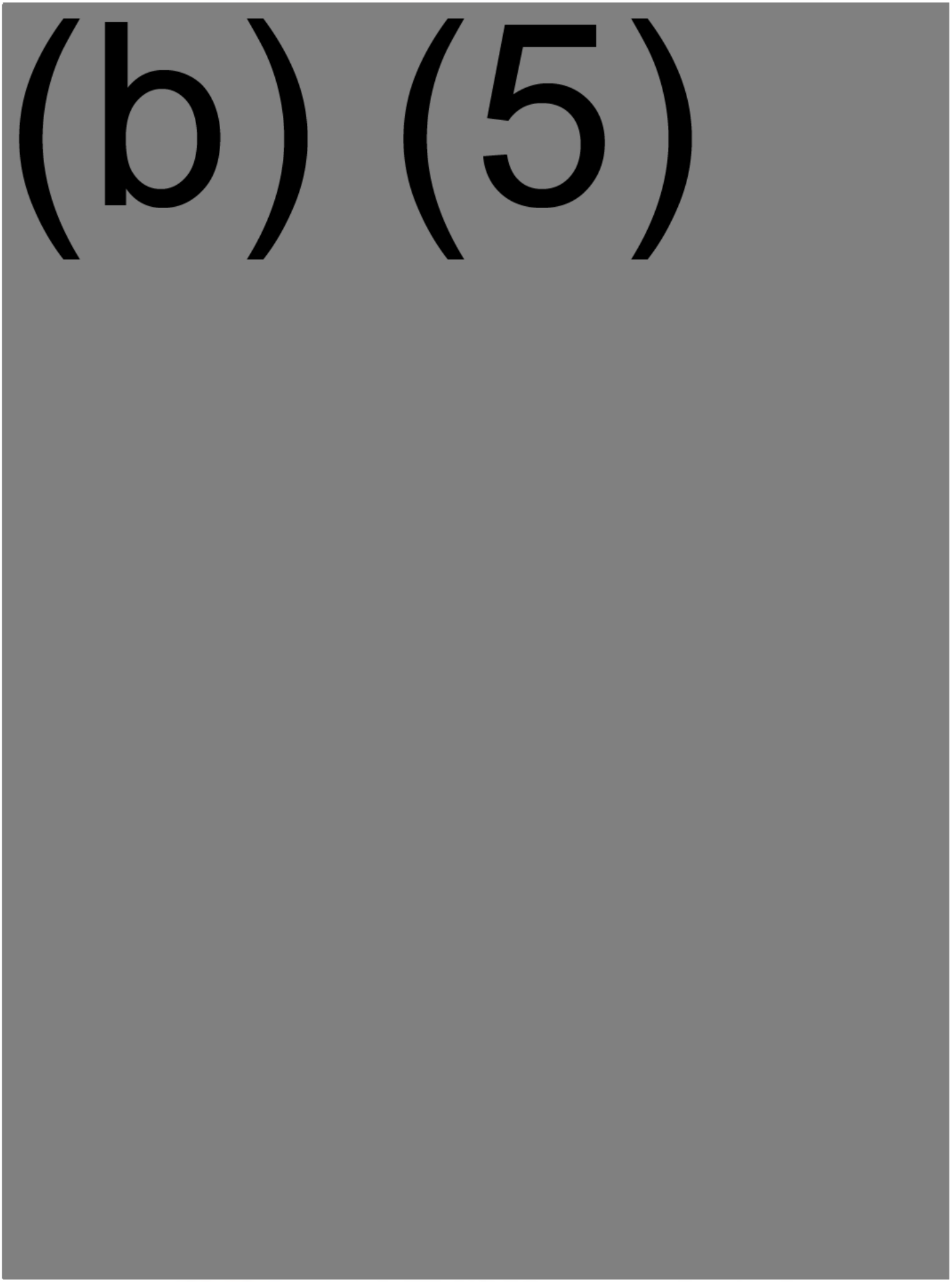
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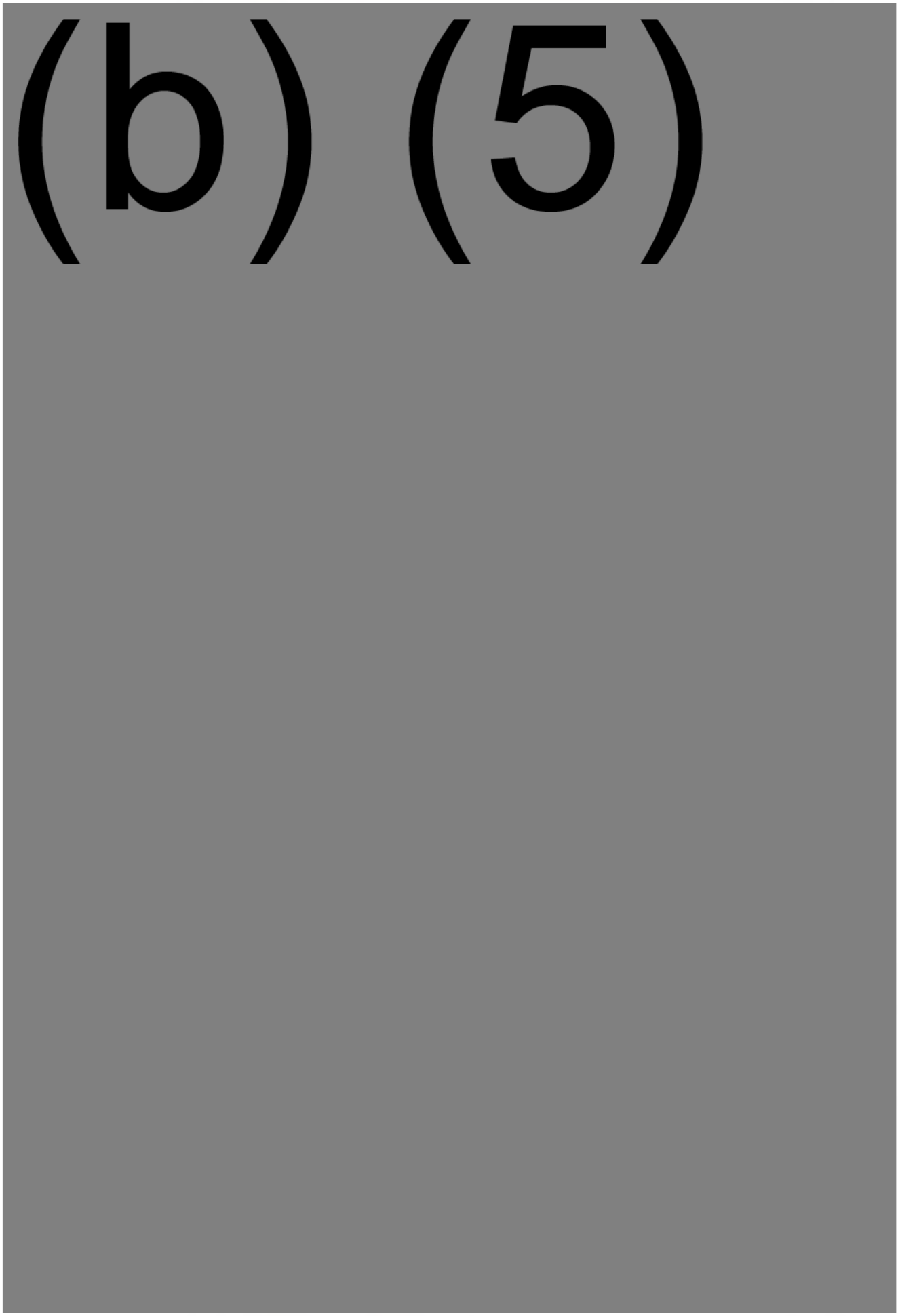
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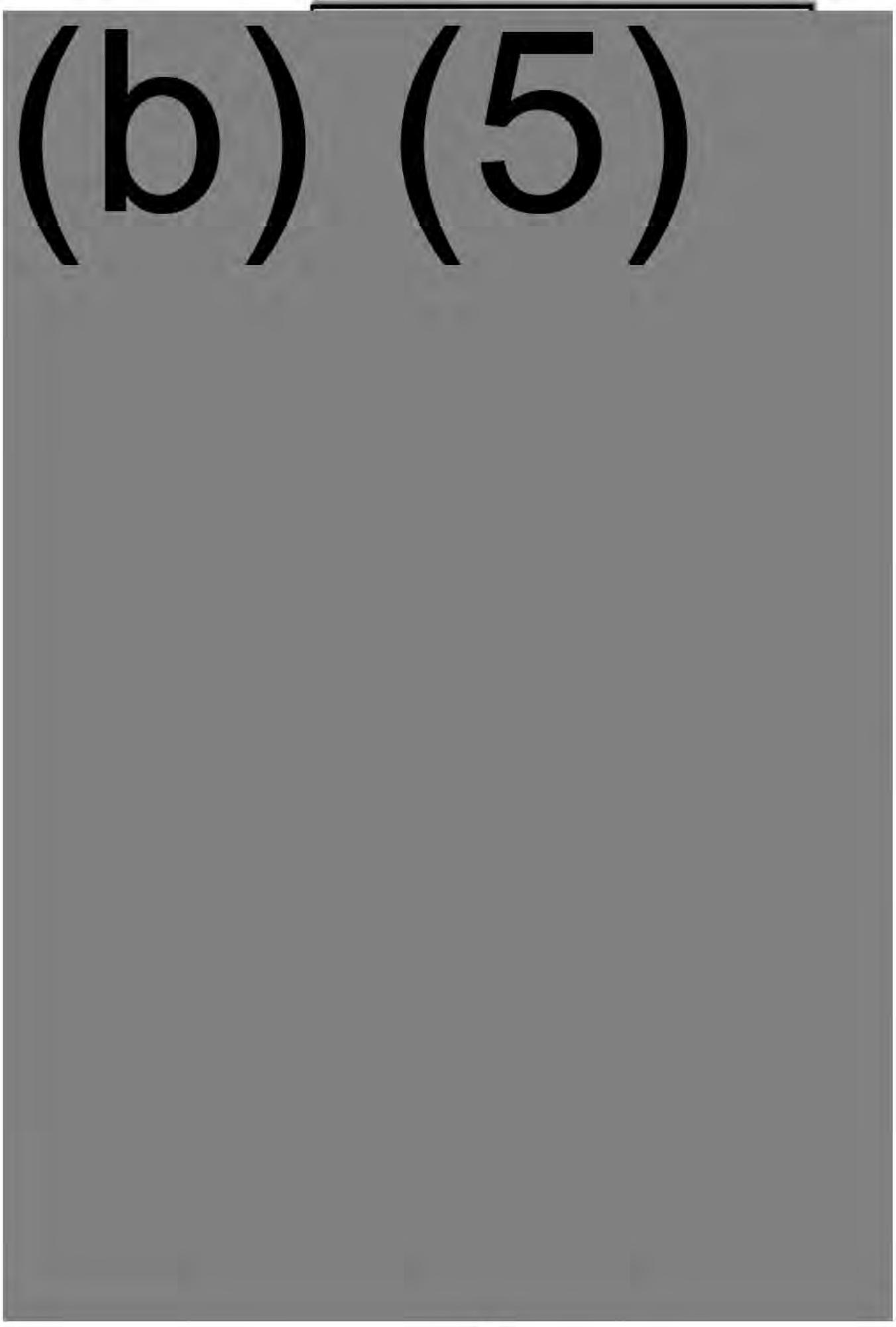
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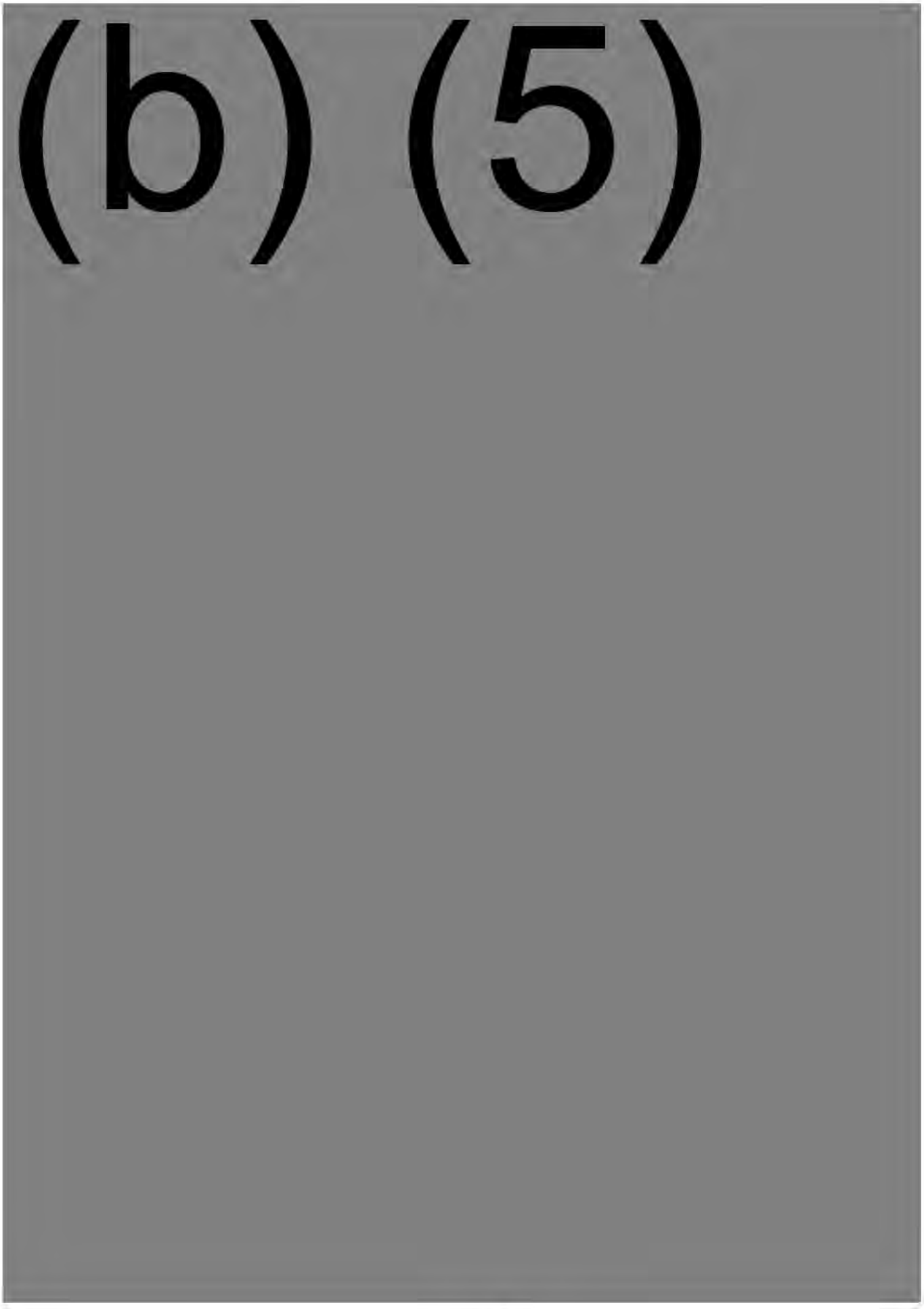
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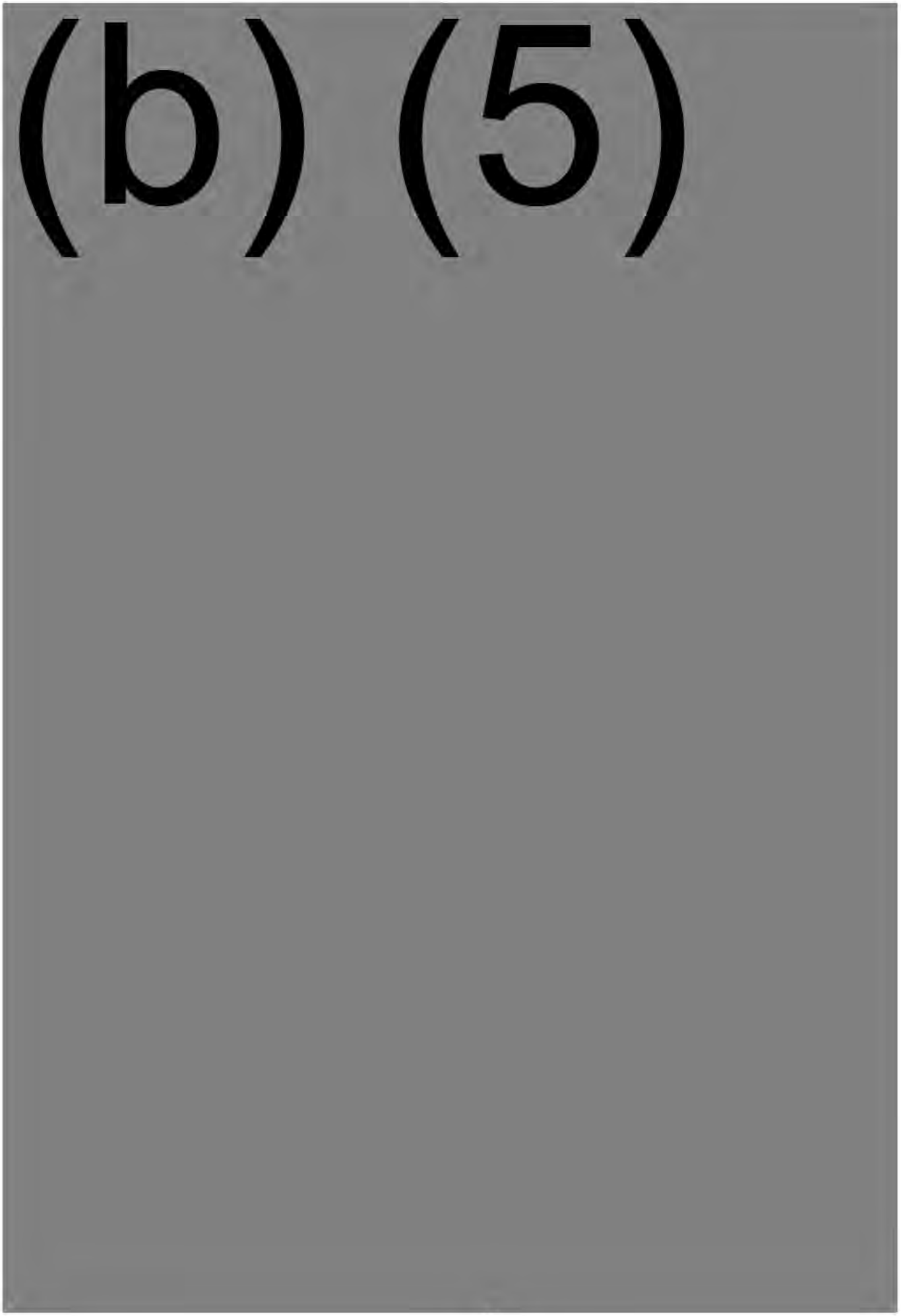
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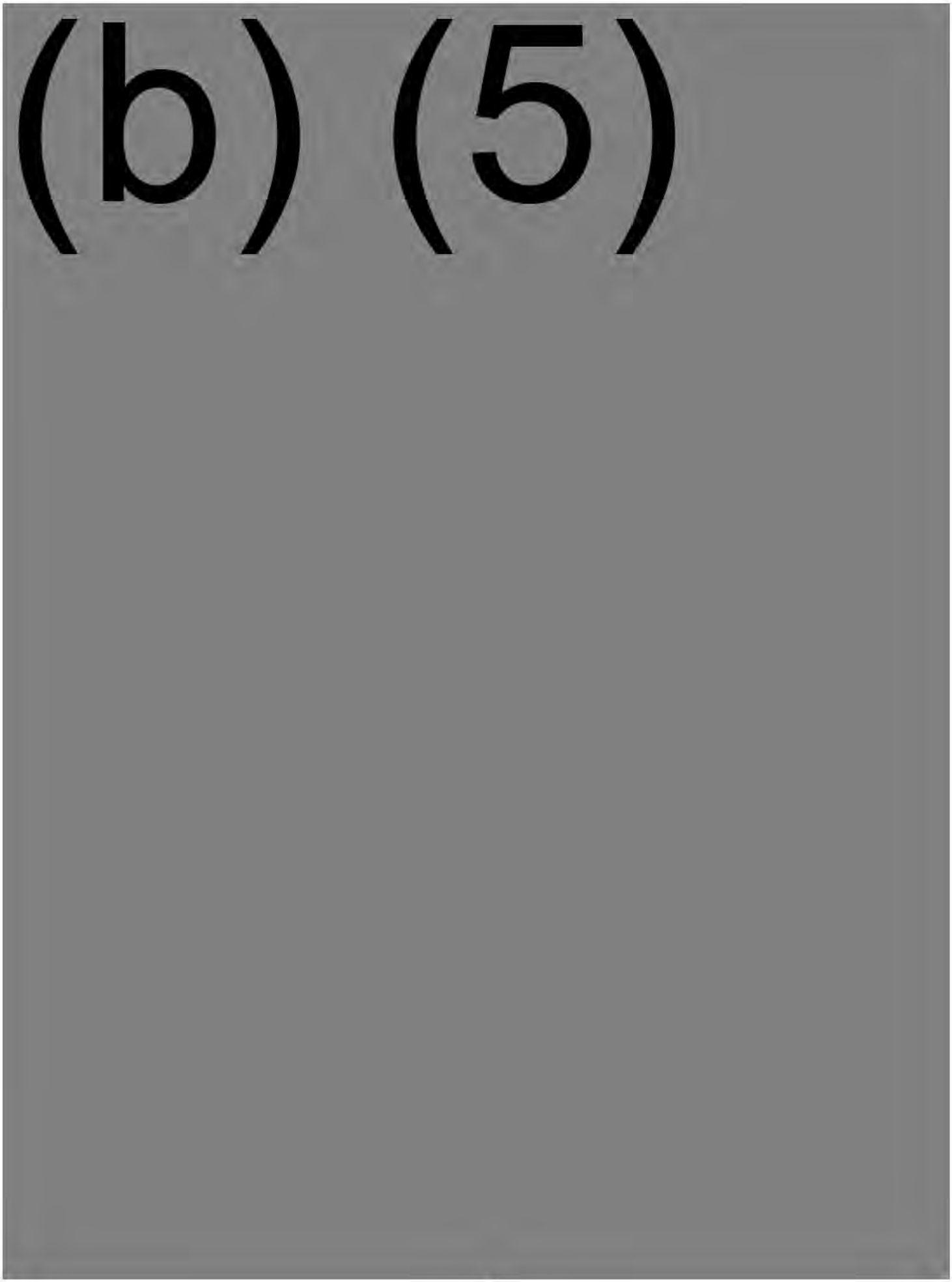
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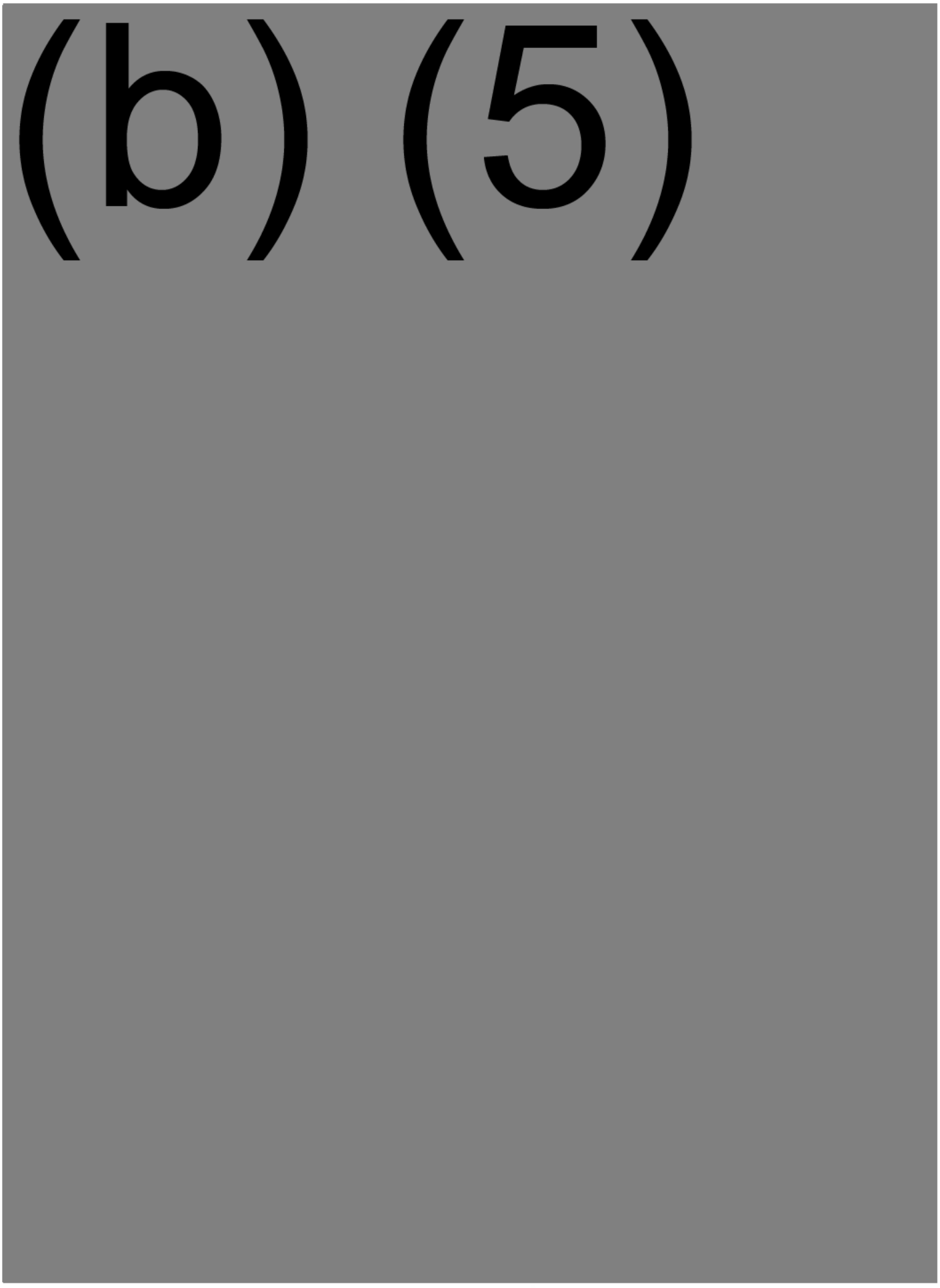
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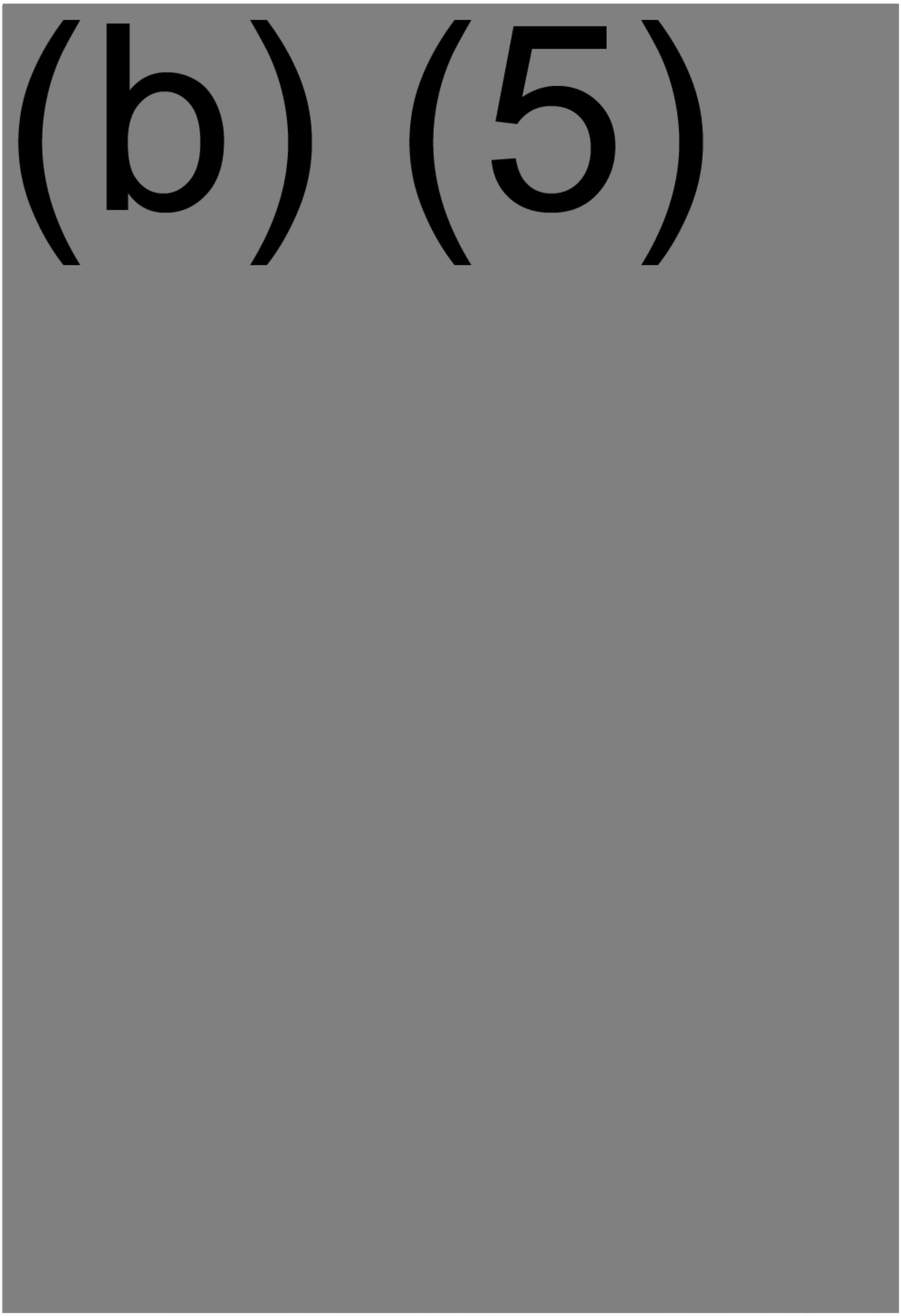
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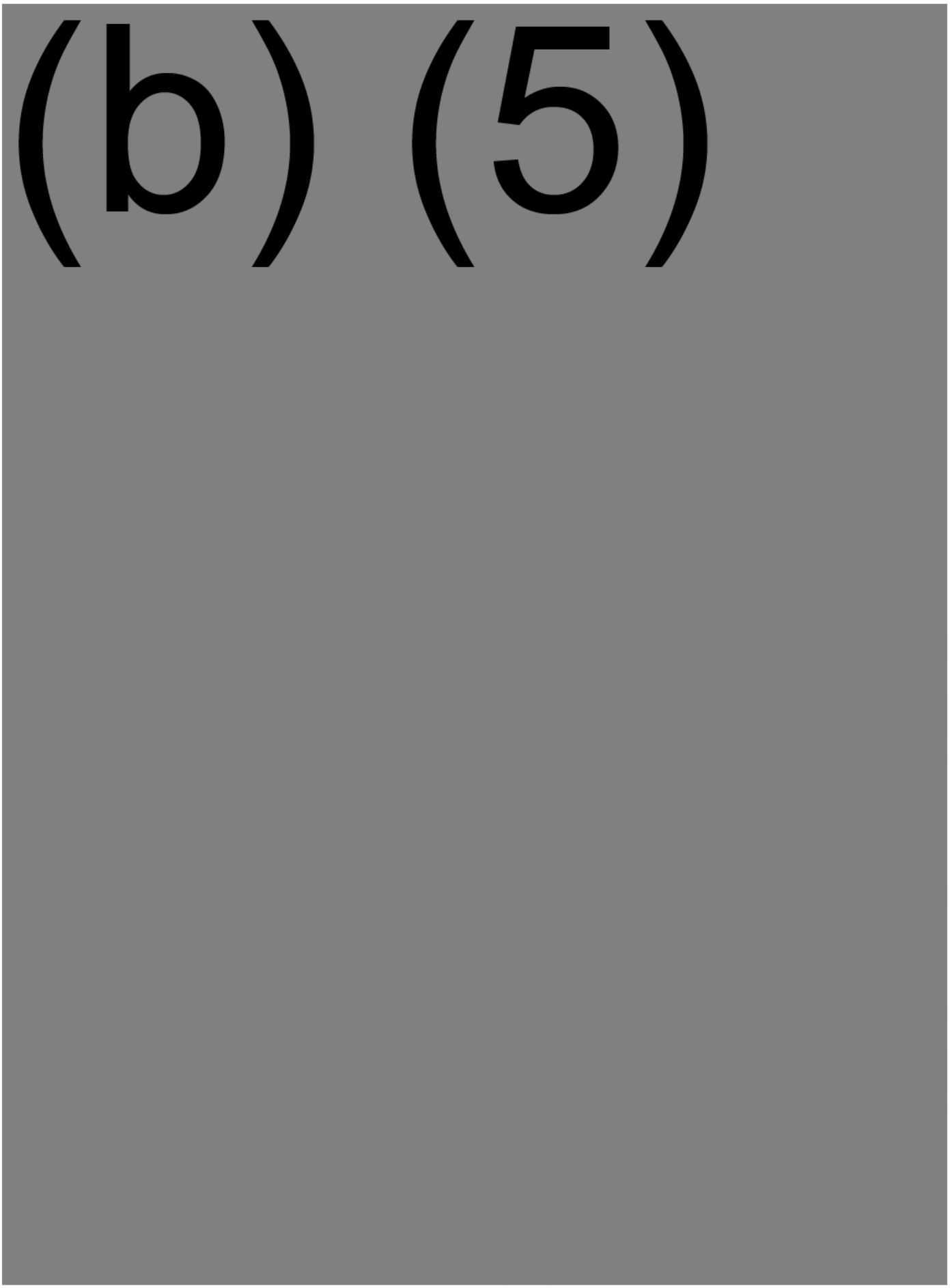
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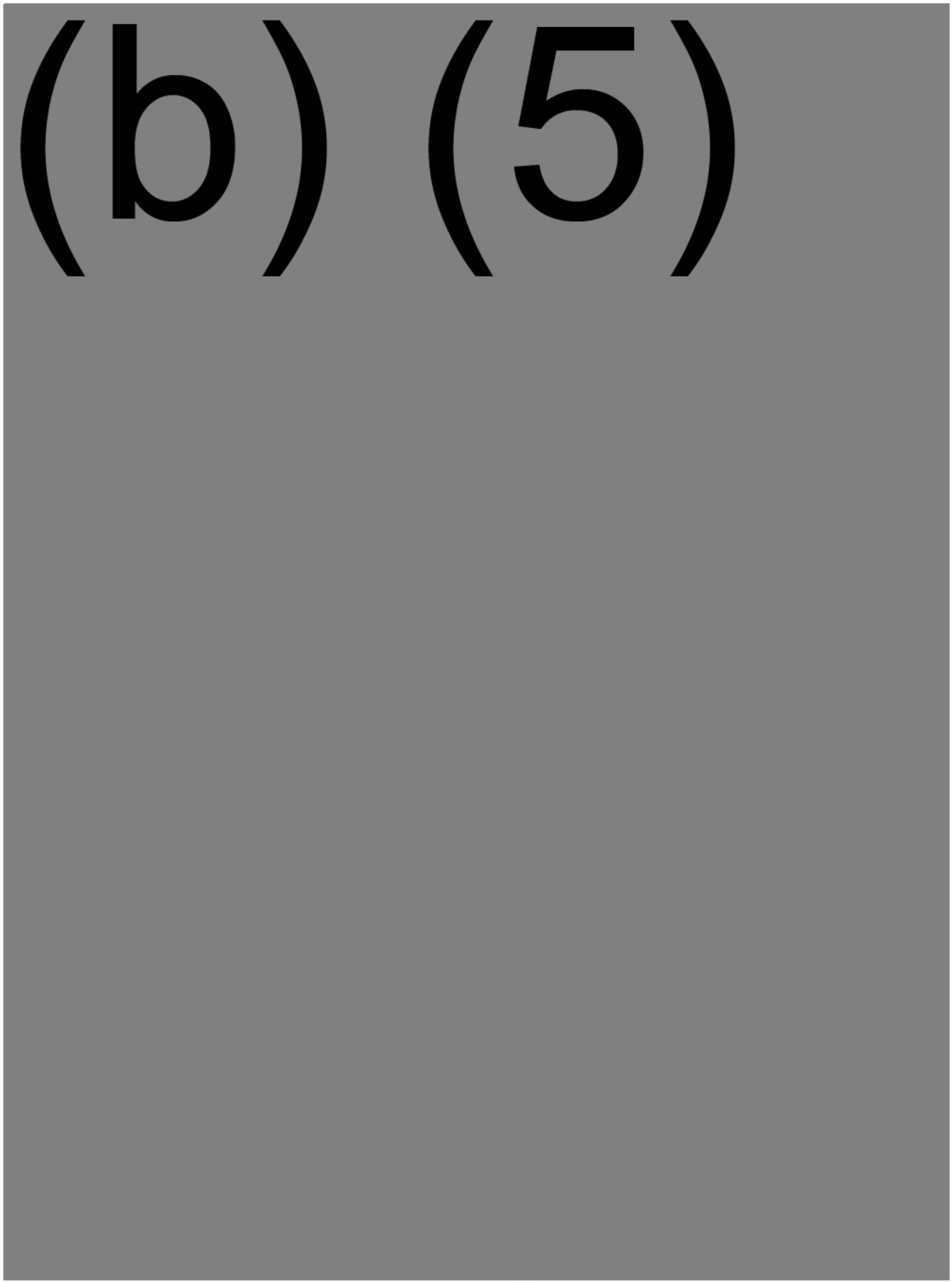
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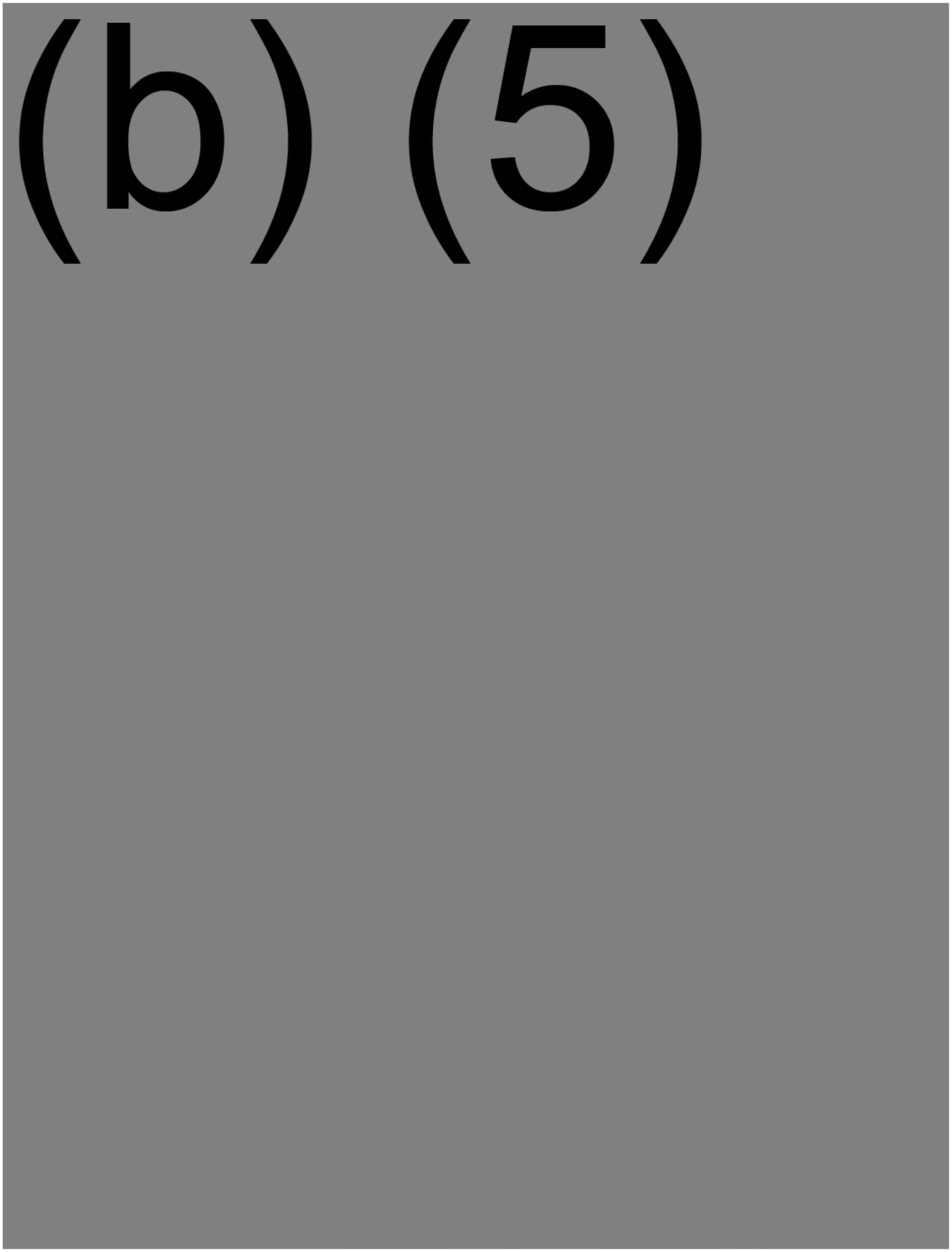
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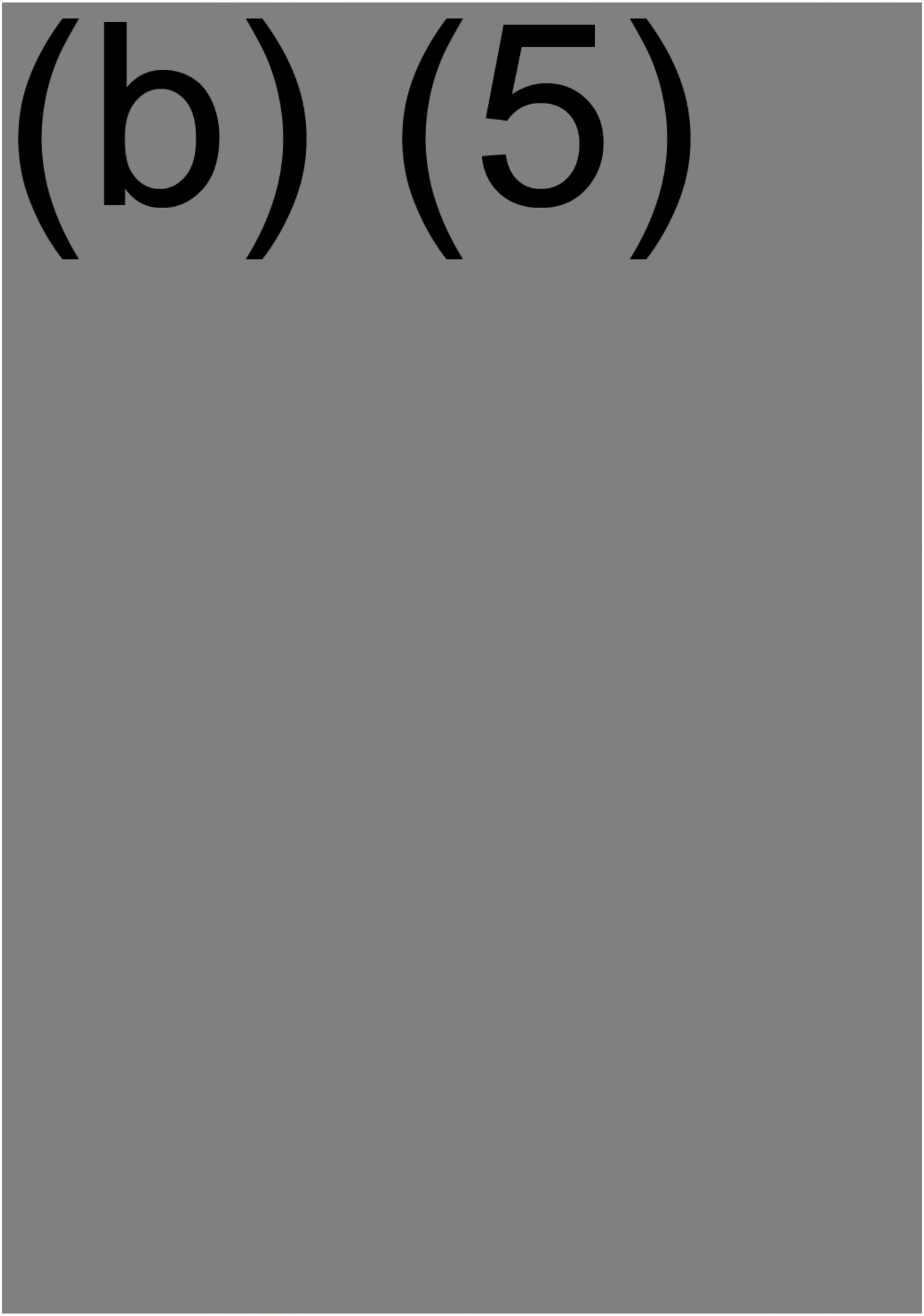
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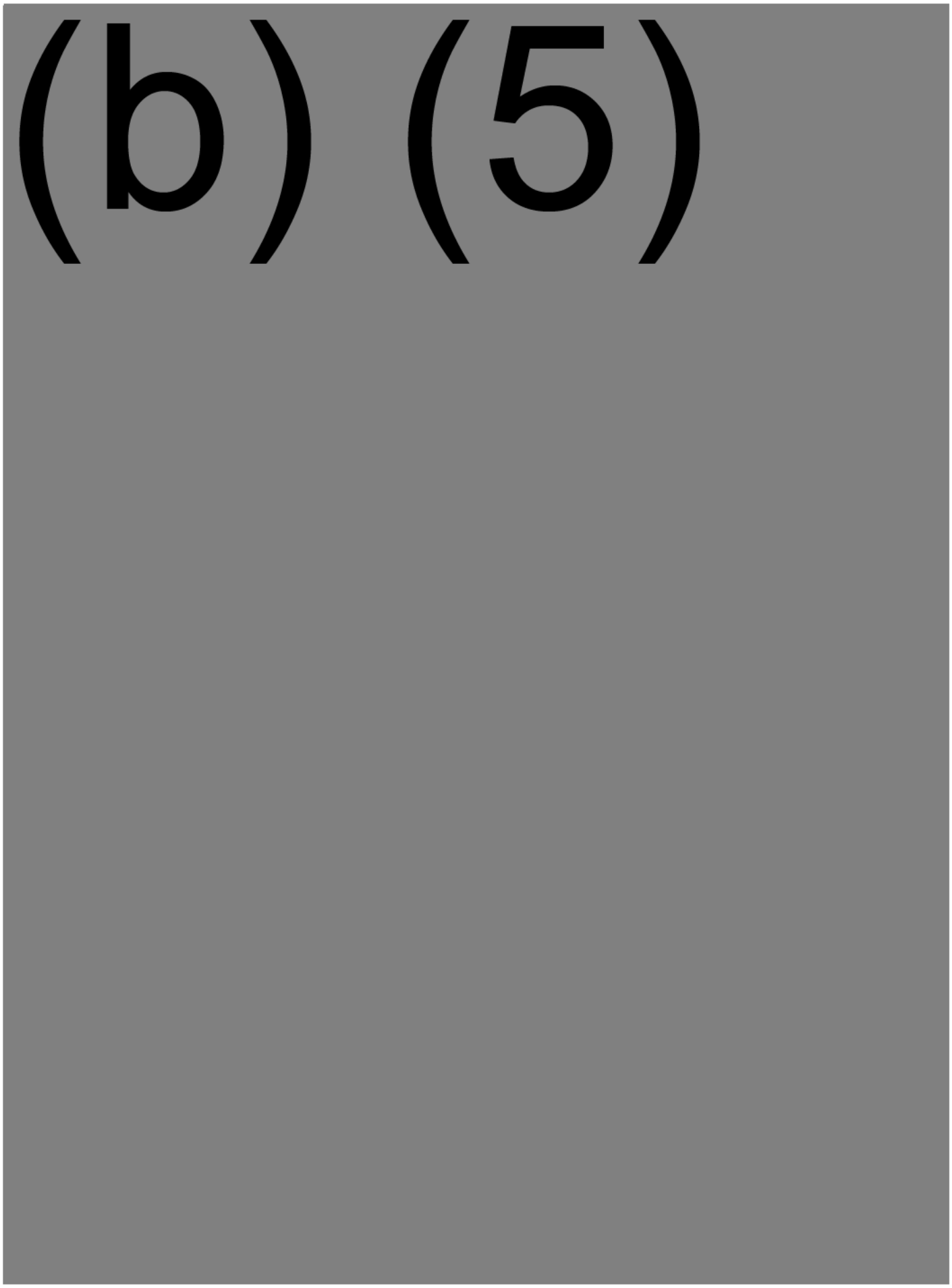
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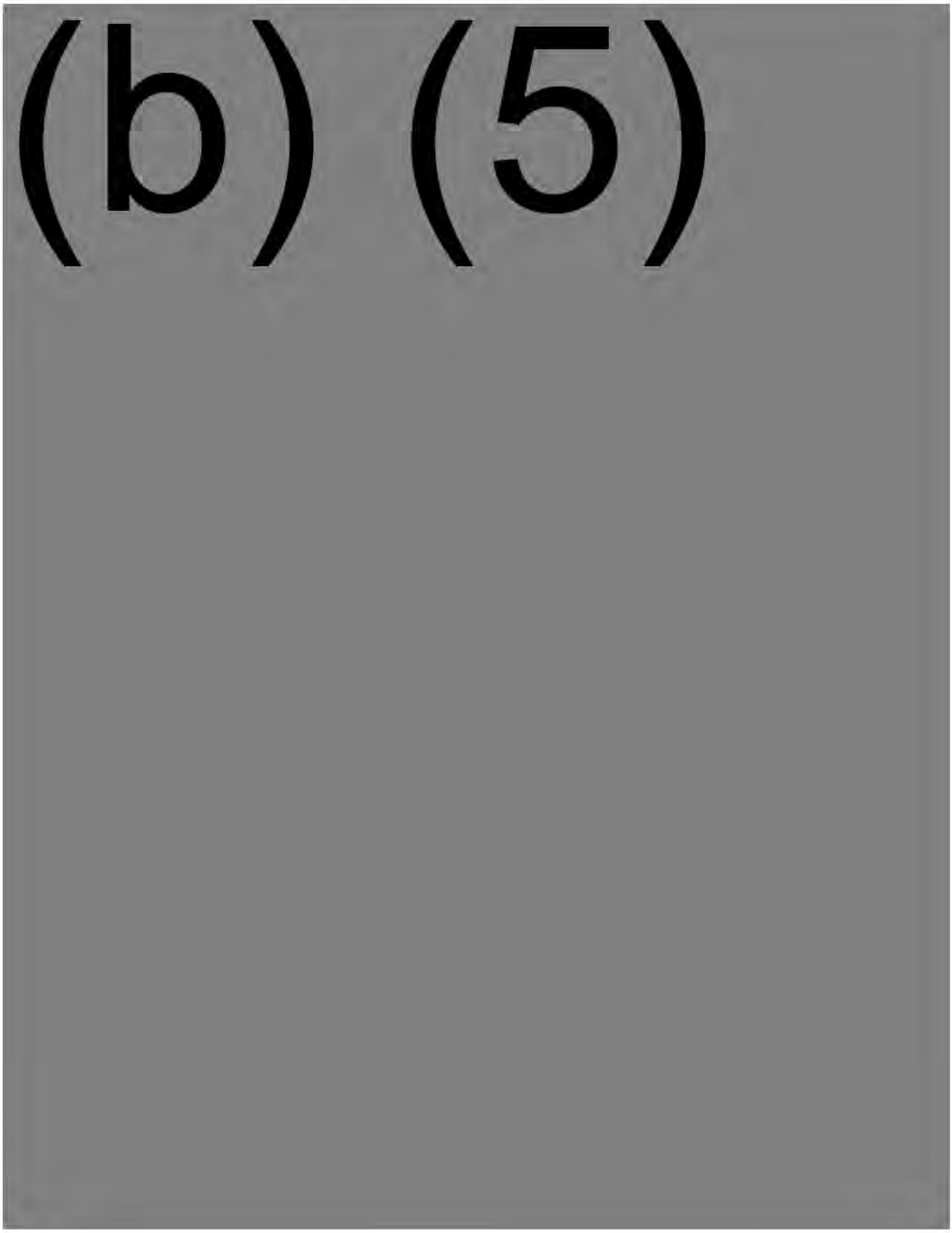
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[EXTERNAL] Fwd: (b) (5)

From: Ann Hickey (b) (6)

To: "Waterman, Paige E. EOP/OSTP" (b) (6)

Date: Wed, 08 Apr 2020 12:17:46 -0400

Attachments: (b) (5) COVID.docx (22.61 kB)

Resending (b) (5))

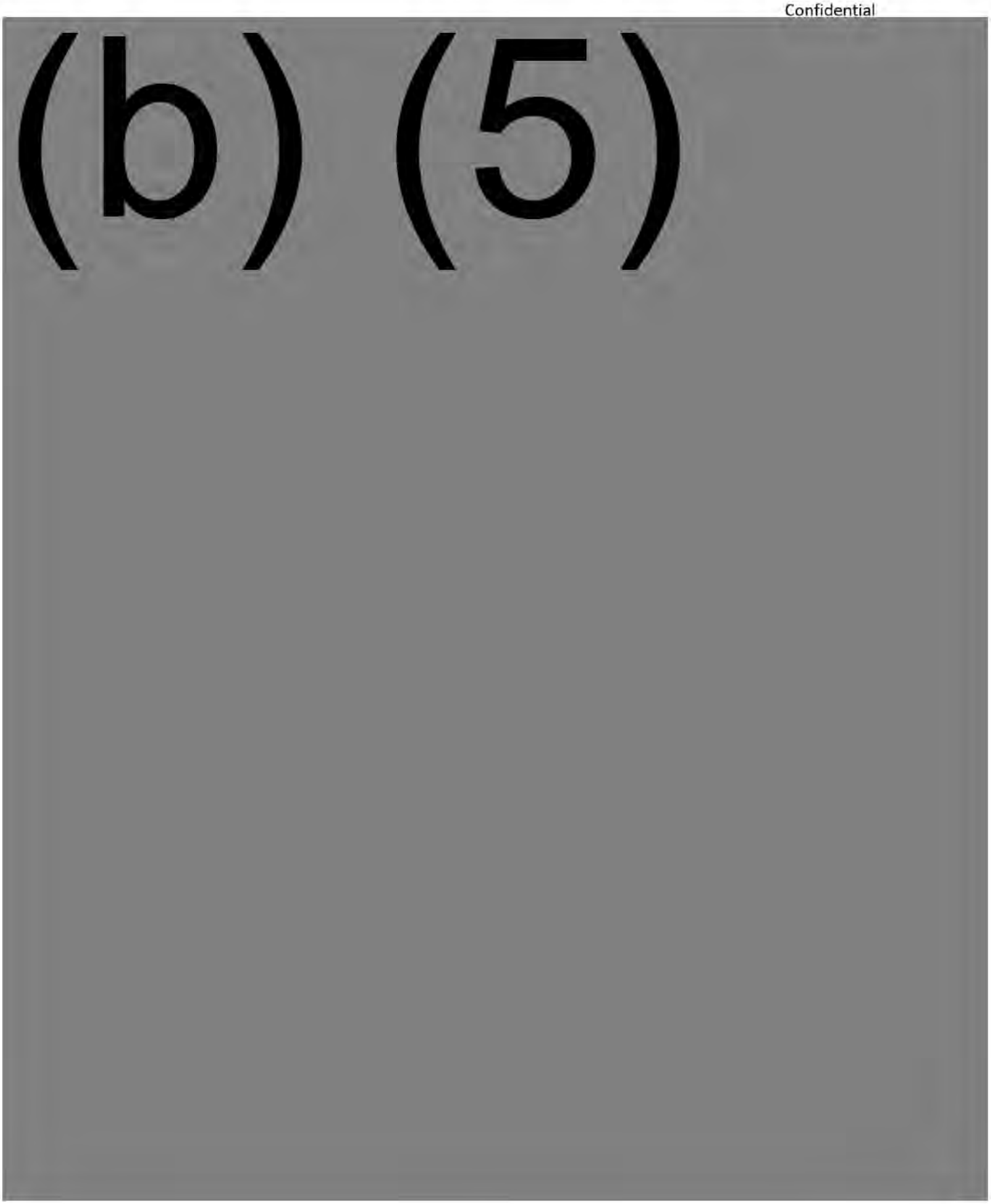
---------- Forwarded message ---------
From: **Waterman, Paige E. EOP/OSTP** (b) (6)
Date: Sun, Mar 22, 2020 at 1:27 PM
Subject: Re: (b) (5))
To: Ann Hickey <(b) (6) Blythe Adamson (b) (6)

Paige E. Waterman, M.D.
Assistant Director for Biological Threat Defense
Office of Science and Technology Policy (OSTP)
Office: (b) (6)
Cell: (b) (6)
NIPR: (b) (6)

On Mar 22, 2020, at 1:15 PM, Waterman, Paige E. EOP/OSTP (b) (6) wrote:

(b) (5) .

PAIGE E. WATERMAN, MD, FIDSA, FACP
Assistant Director for Biological Threat Defense
Office of Science and Technology Policy
Desk: (b) (6)
Cell: (b) (6)
NIPR: (b) (6)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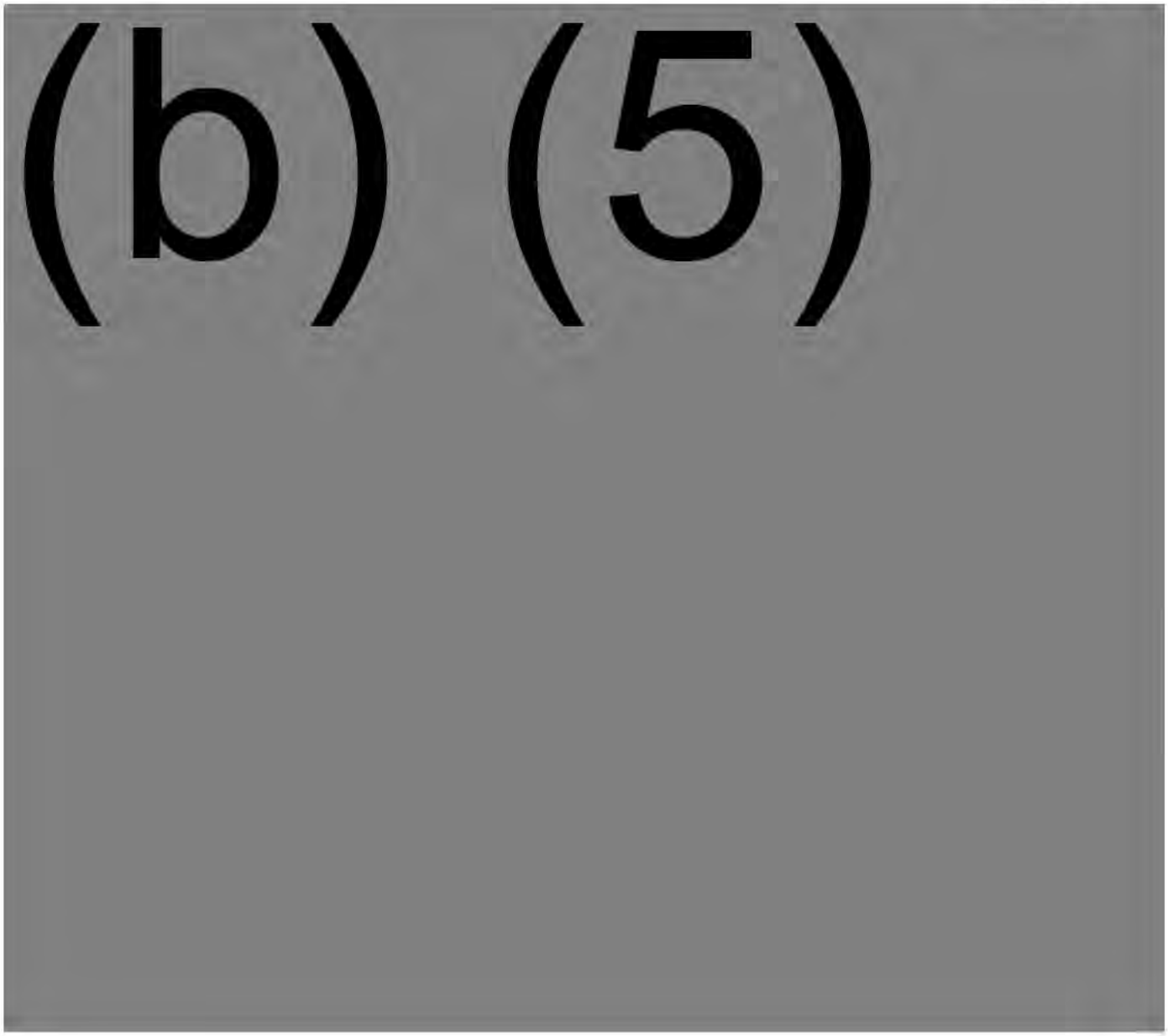
(b) (5)

[EXTERNAL] r4 update and screen mock-ups

From: Chris Sarley <(b) (6)

To: "Bonyun, Sean C. EOP/OSTP"(b) (6)

Date: Fri, 10 Apr 2020 14:01:52 -0400

Attachments: r4 Economic Restart System Screen Shots.pdf (5.39 MB); r4 Technologies Economic Restart Solution.pdf (115.01 kB)

Hey man – hope things aren't at as much of a breakneck pace as they were a few weeks ago. Attached are two documents I wanted to share with you as I believe they might also make their way directly to Kratsios. The first is examples of screen shots of what the user sees from the r4 platform with some explanations. The second is a shorter version that is refined from what I have previously shared with you to give a clear picture on how the platform would help decision makers predict where progress is being made, in real time, so that economic restarts can be made, safely. The system is ready and can be turned on now, to help the federal government, right away. This is perfect for SWAT teams as it does not require any data scientists on the part of the Administration to operate it.

Let's connect over the phone if you have a few minutes early next week and catch up. I would also welcome getting the r4 team connected with some of your modeling folks to understand what challenges they are dealing with and if and where they might be able to plug in to provide immediate assistances with data sets and modeling they are already standing up – the beauty of r4's ability to integrate with data sets already underway.

Best,

Chris

Chris Sarley
Principal | Government Affairs
D(b) (6) M(b) (6)

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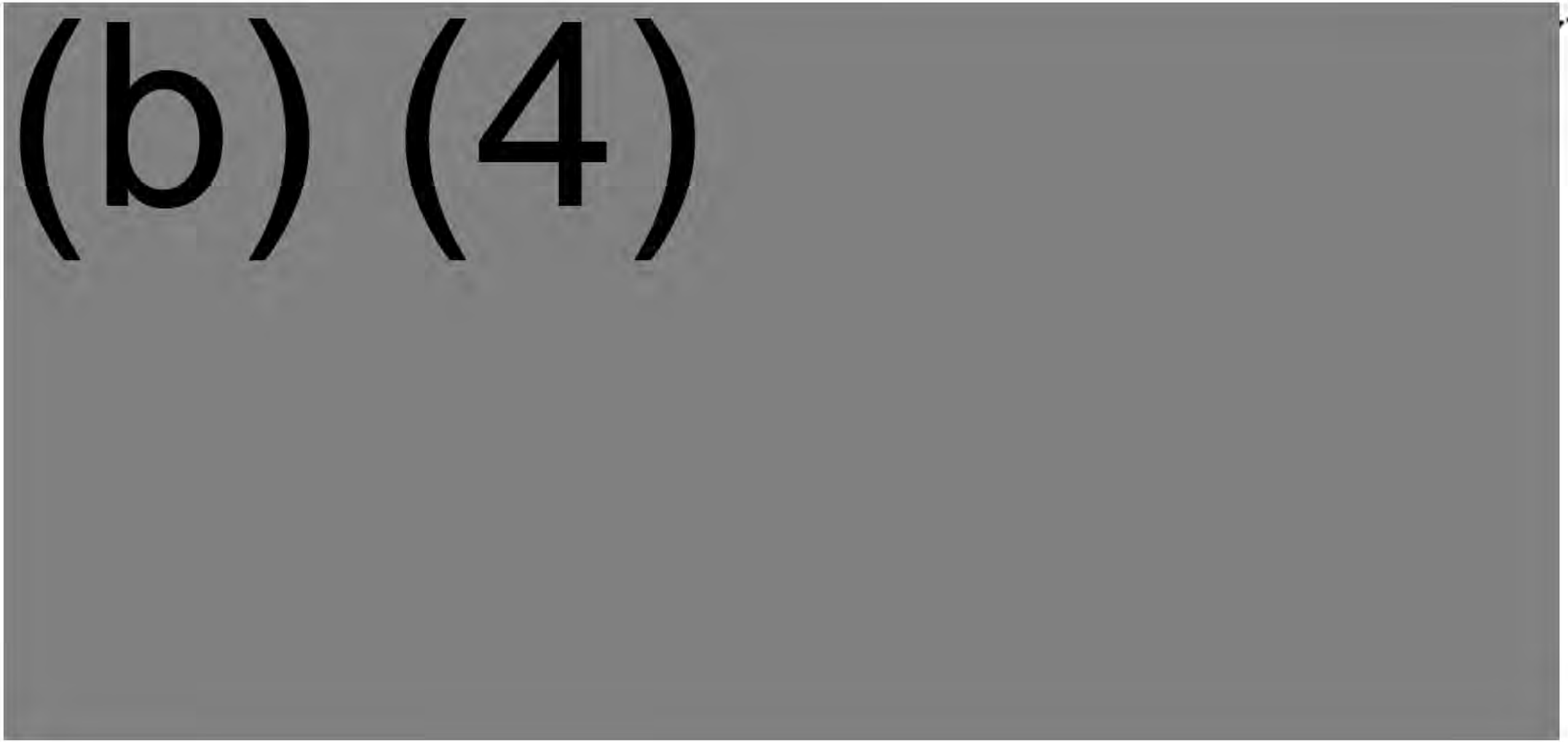
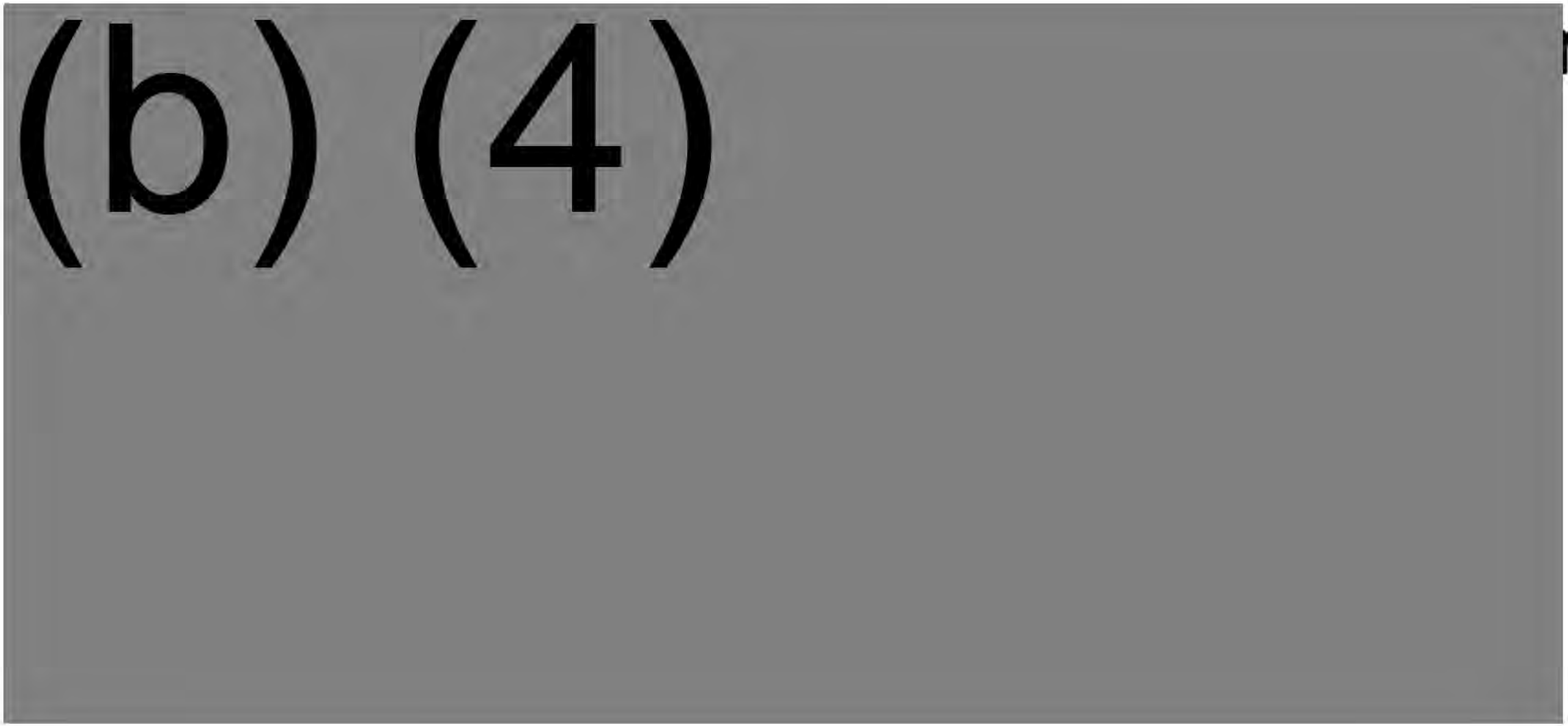
>www.cgagroup.com< | @cgagroup

The r4 Market-Model Solution to Drive Smart Economic Restart

Screen Shots in Use by Commercial Companies to Manage COVID-19 Supply Disruption

April 2020





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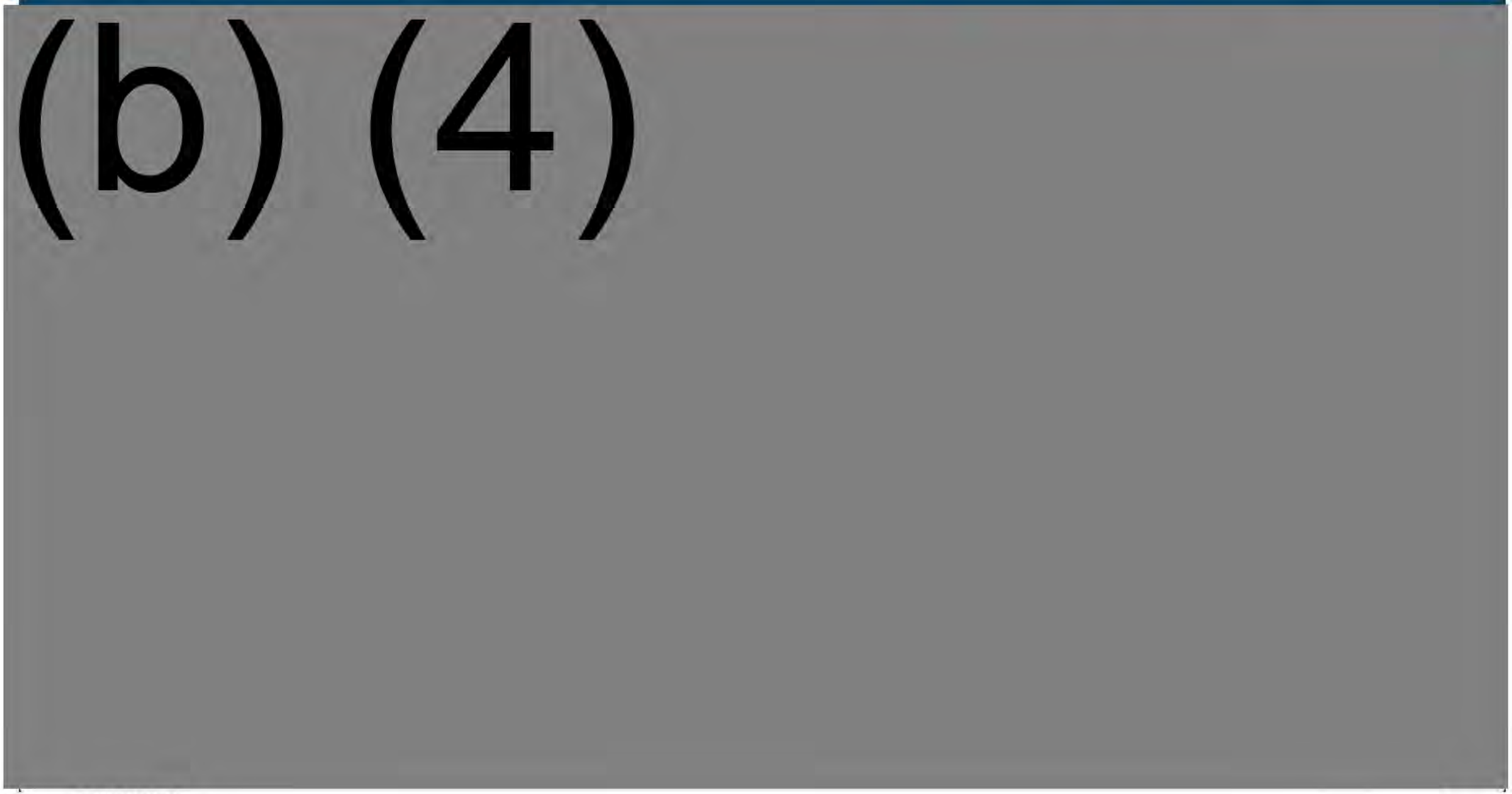

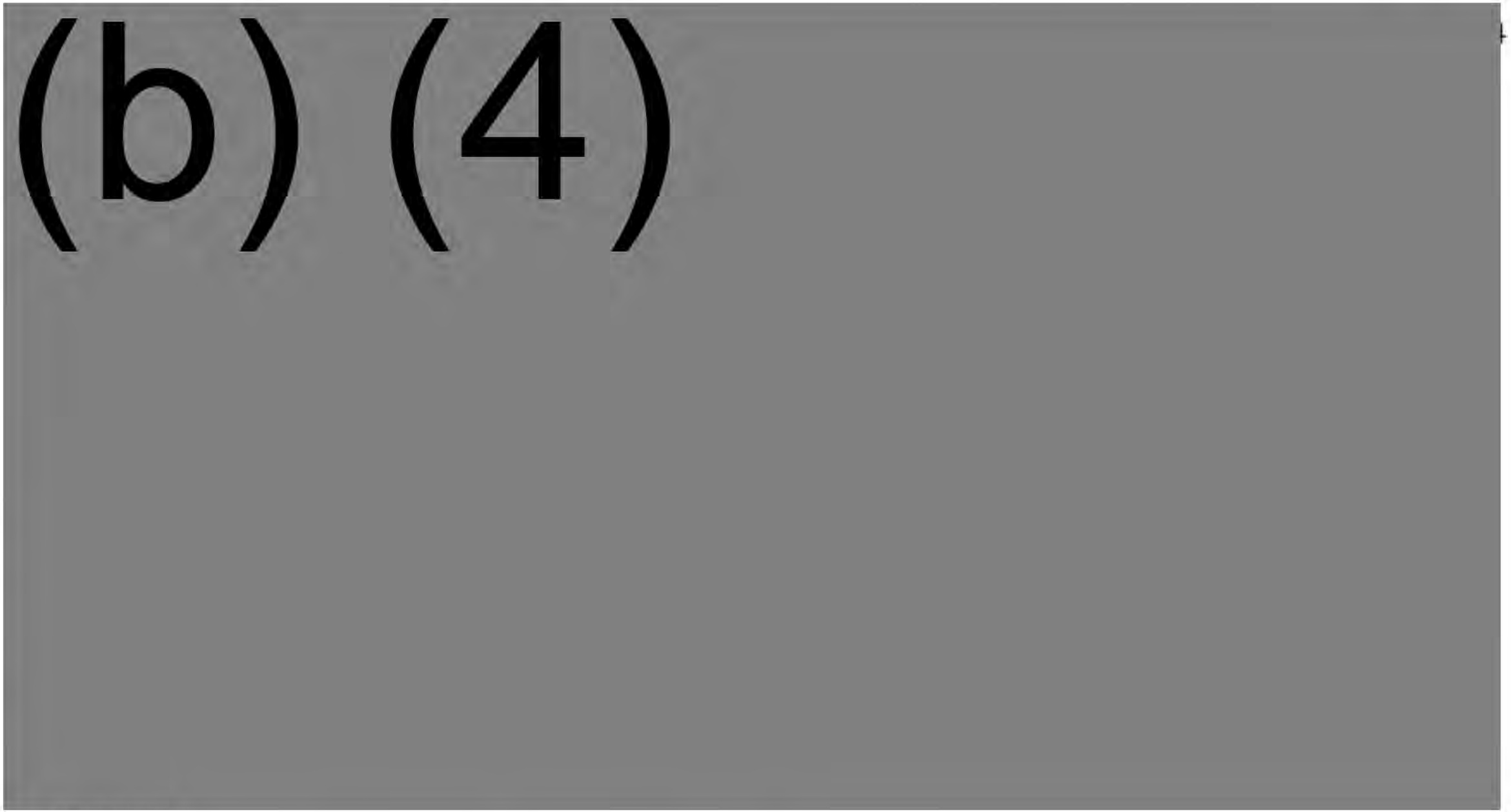

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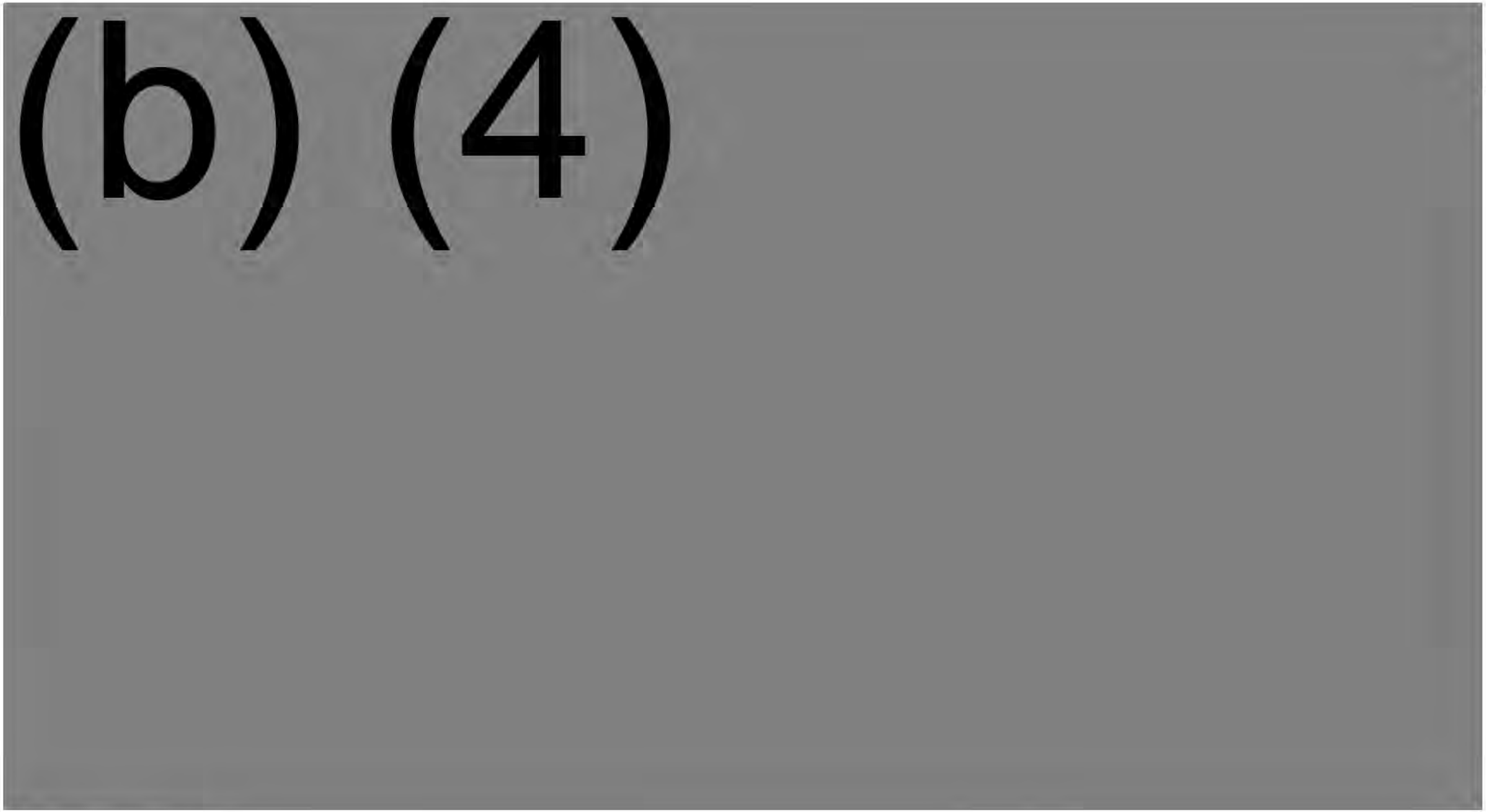

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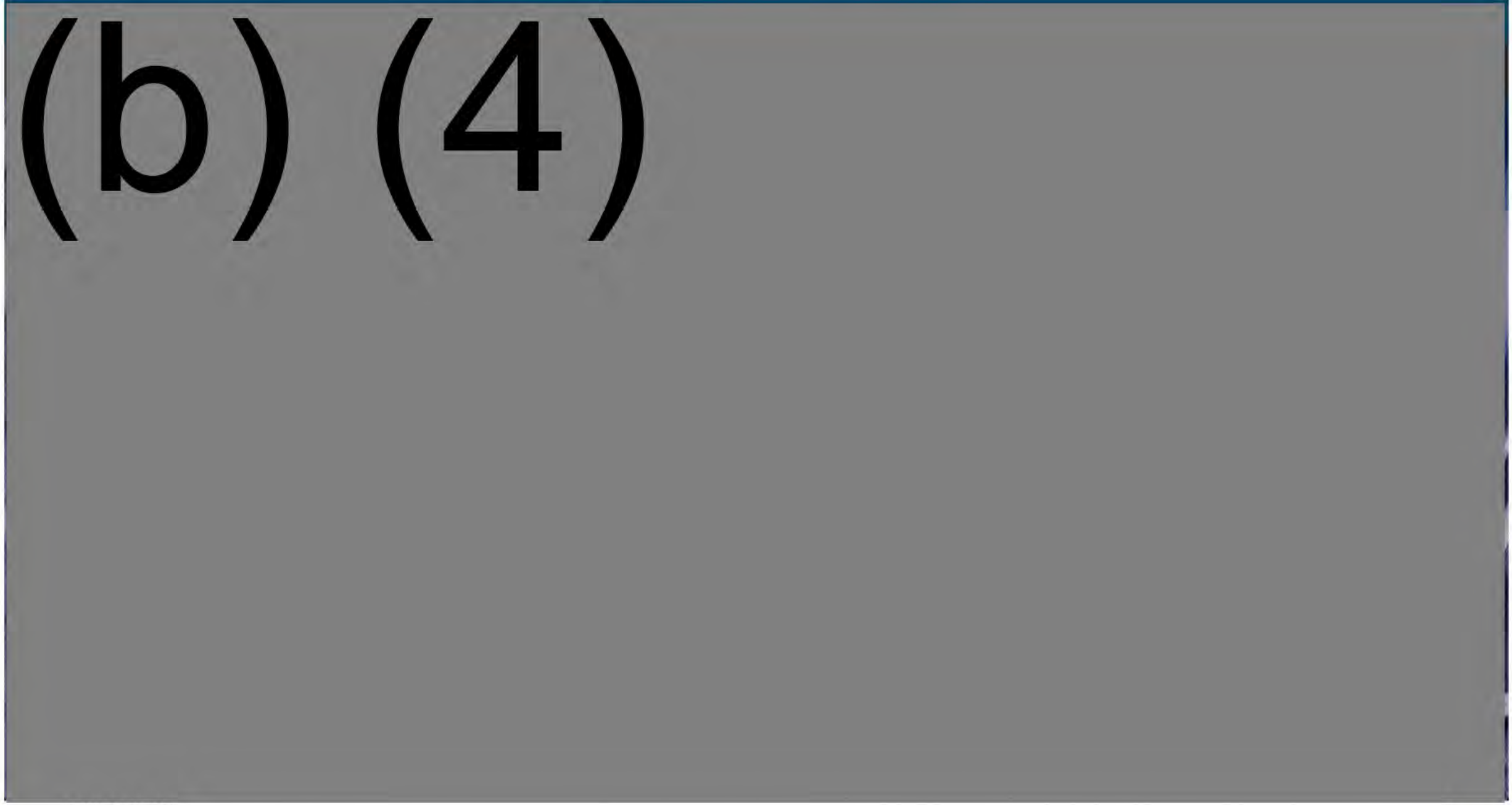

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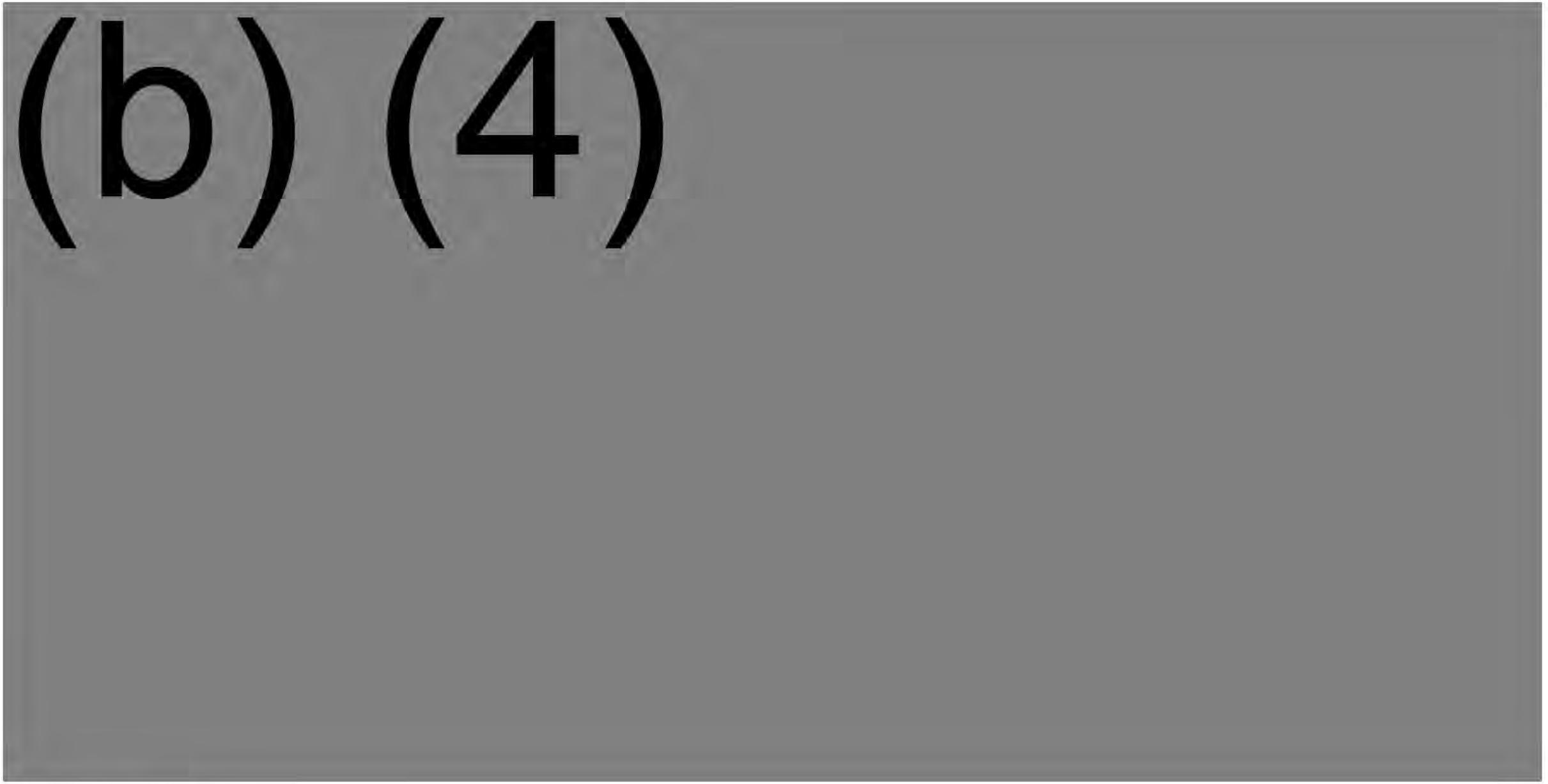


10

The Business of Better™

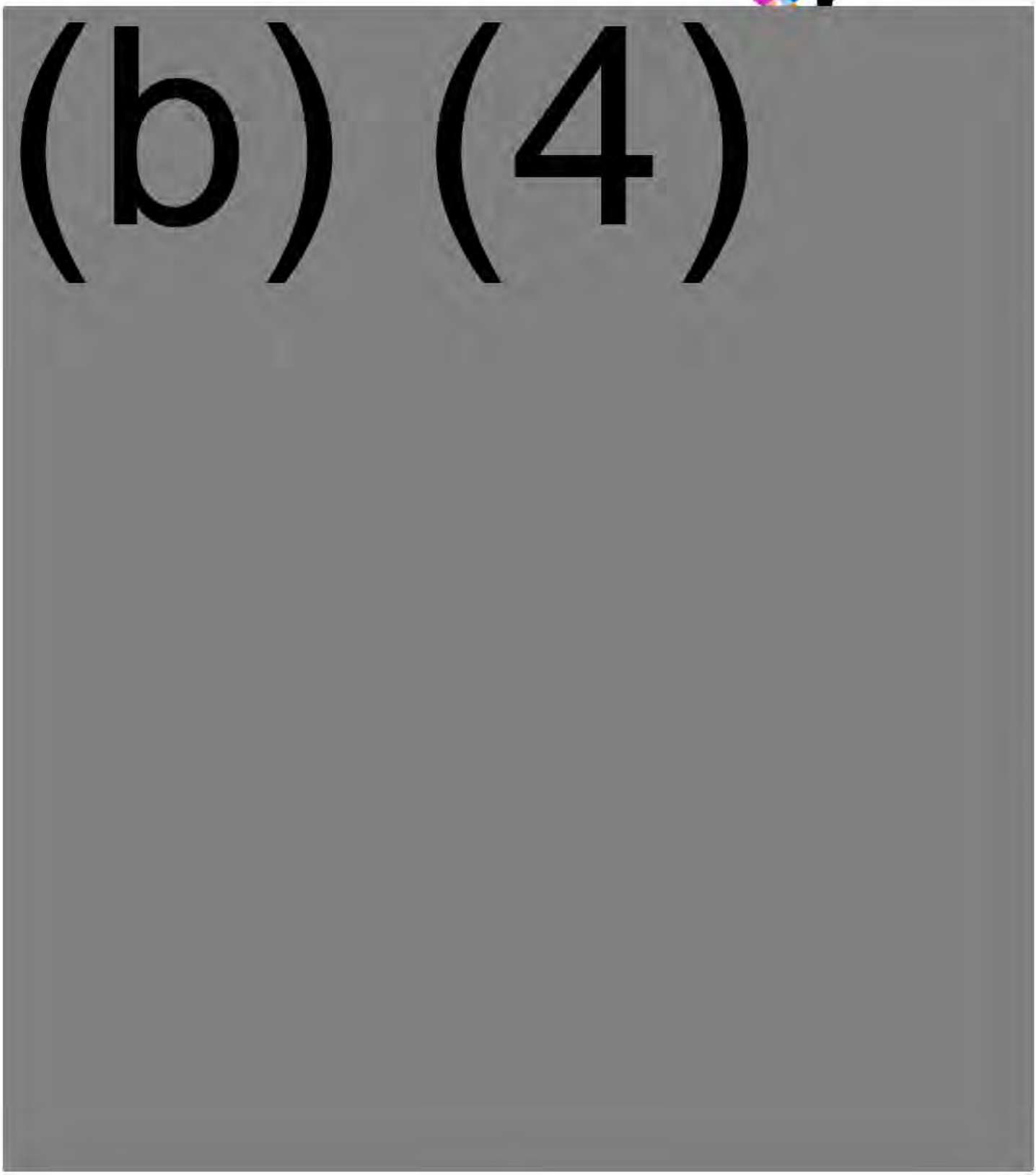
CONTACTS

Paul Breitenbach
CEO
(b) (6)
(b) (6)

David Bradley
EVP Solutions
(b) (6)
(b) (6)

Paul Signorelli
Chief Solution Architect
(b) (6)
(b) (6)

11



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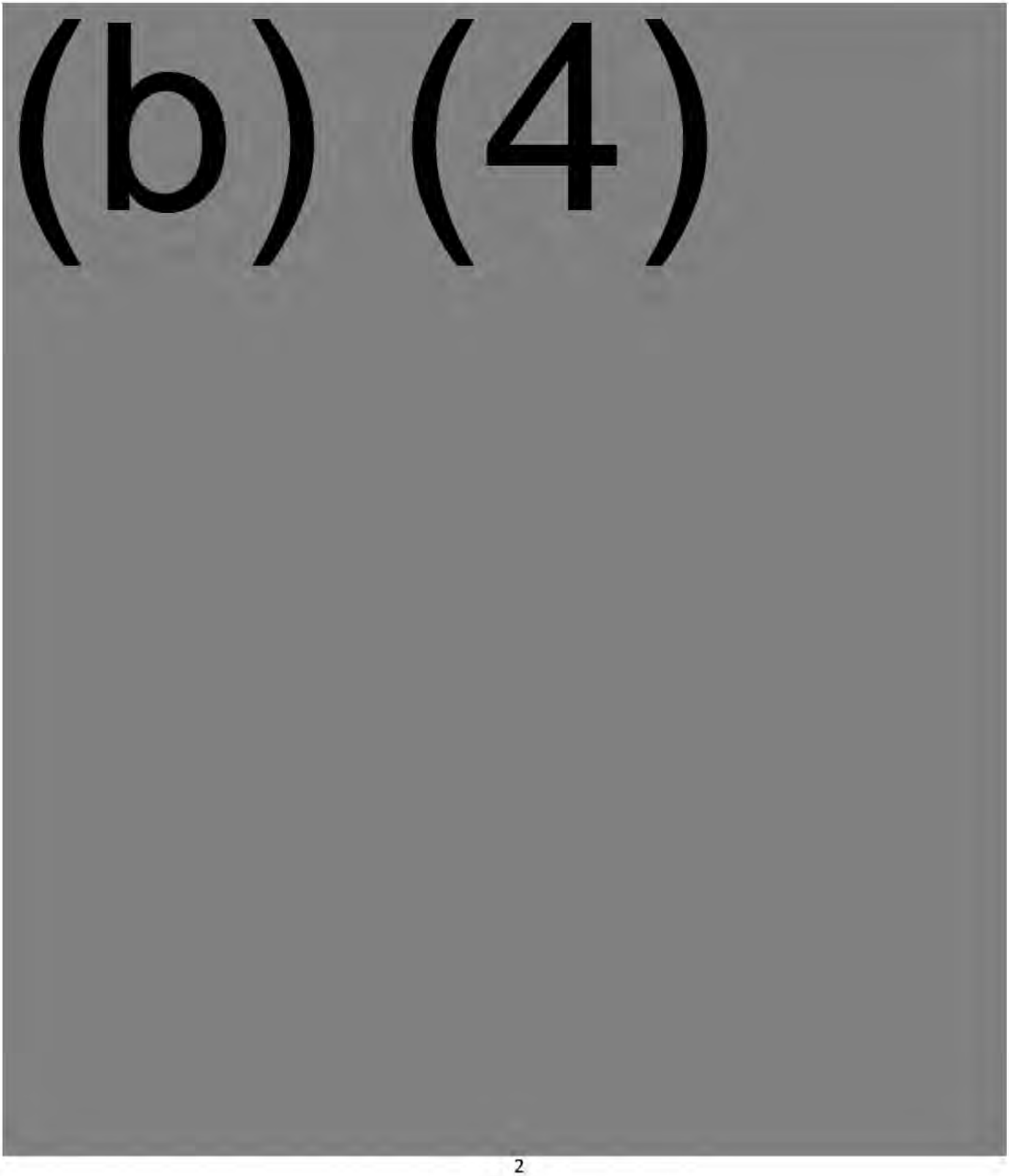

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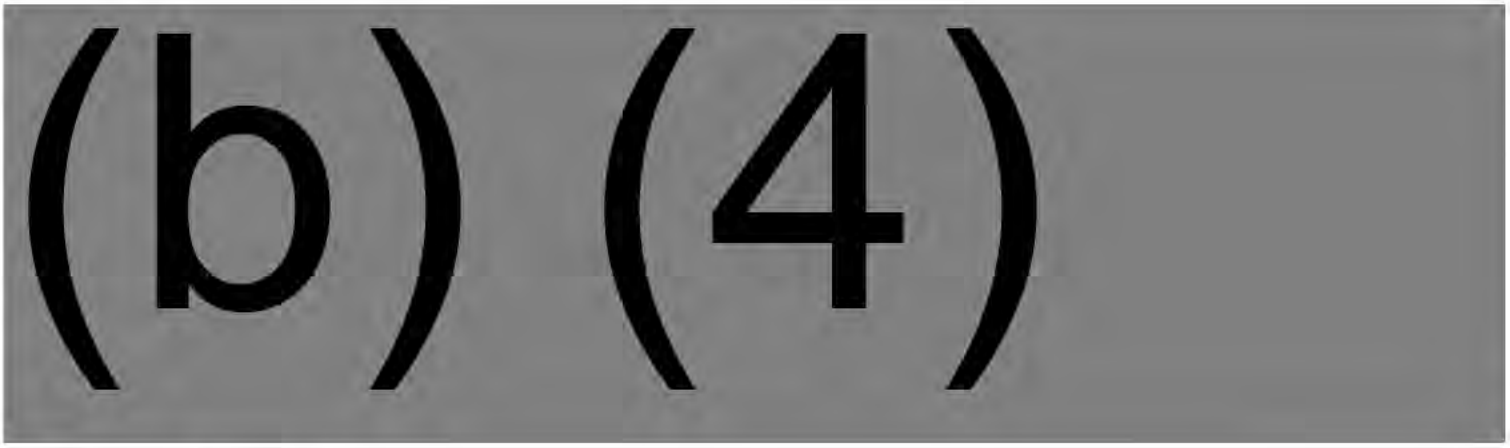

Contact Information:
Paul Breitenbach
CEO r4
(b) (6)

3

[EXTERNAL] COVID - 19 Monitoring

From: Will Saunders (b) (6)

To: "Waterman, Paige E. EOP/OSTP" <(b) (6)

Cc: (b) (6)

Date: Mon, 13 Apr 2020 09:40:45 -0400

Attachments: COVID 19 Suggestions AAH 4 13 2020.pdf (1.07 MB)

Dr. Waterman -
It was a pleasure to connect with you on Sat.
Attached please find some suggestions per our conversation. I apologize that the info is a little rough but I wanted to get this to you quickly in the interest of time.
The crux of our most actionable recommendation is to immediately establish a real time monitoring capability to track the transmission of COVID - 19 in Skilled Nursing Facilities using the MDS.

- The MDS is an already-existing infrastructure for collecting the needed demographic and clinical data on SNF residents, and well-established organizations with the capacity to rapidly analyze the data and promptly deliver results in an actionable form.
- The MDS is a Federally-mandated comprehensive multidisciplinary structured assessment that is completed by SNF staff and submitted electronically in a standard file format suitable for immediate analysis. Completion and prompt electronic submission of MDS assessments has been part of every SNFs' routine for over 15 years. This makes the MDS an ideal vehicle for collecting coronavirus-related data from SNFs.
- MDS software vendors have established capability to include state-specific sections and modify items as required by regulations. They thus could apply their rapid development processes to add a coronavirus-related section to the MDS using their existing, proved capabilities.
- After new MDS content was implemented, the Federal government would contract with one or more qualified organizations to rapidly aggregate and analyze the MDS data submitted to answer critical questions about coronavirus infection and COVID-19 in SNFs and report the answers to the Coronavirus Task Force and to the public.

I have attached an overview of our recommendations and a write up from the largest MDS vendor/clearing house in the country. There are several other vendors that could be convened as well, but Pointright is the predominant player.
I have also attached some thoughts on the opportunity to provide additional clinical and remote access supports to SNFs and other LTC providers, but these solutions would not be as immediate as the above.

As I expressed on the phone, I am happy to provide any support to you in the process that I can.
I also feel the need to sincerely thank you for your services to our country.
My cell is (b) (6) .
All the best -
Will Saunders
Founder& CEO
AllyAlign Health, Inc.

AllyAlign Health operates Medicare Advantage plans across the country solely focused on vulnerable, frail elderly members residing in a long - term care setting.

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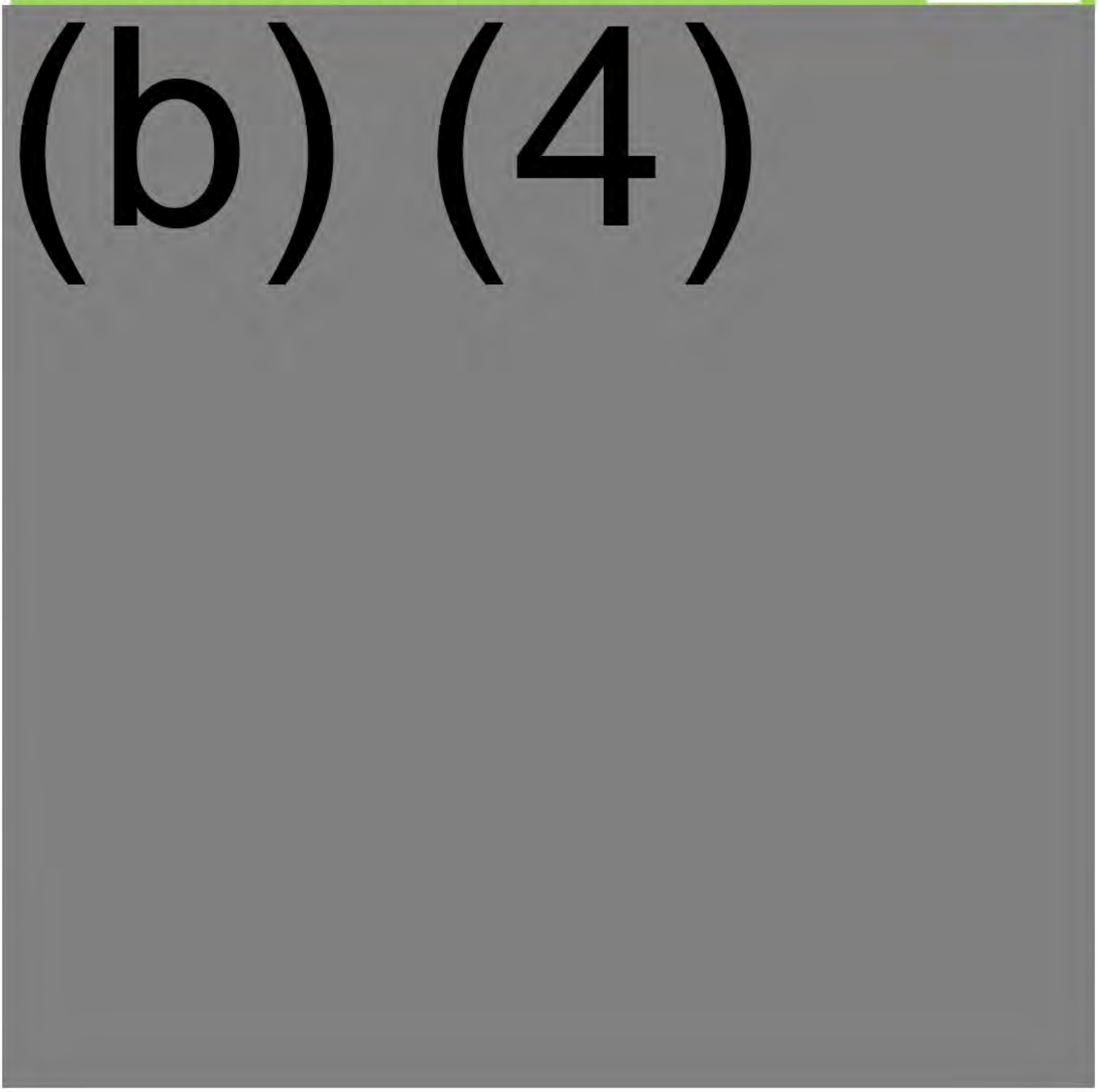
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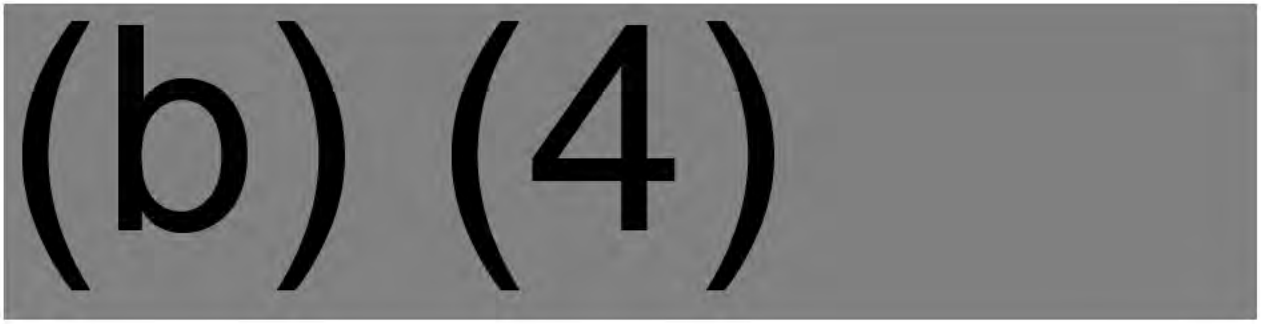
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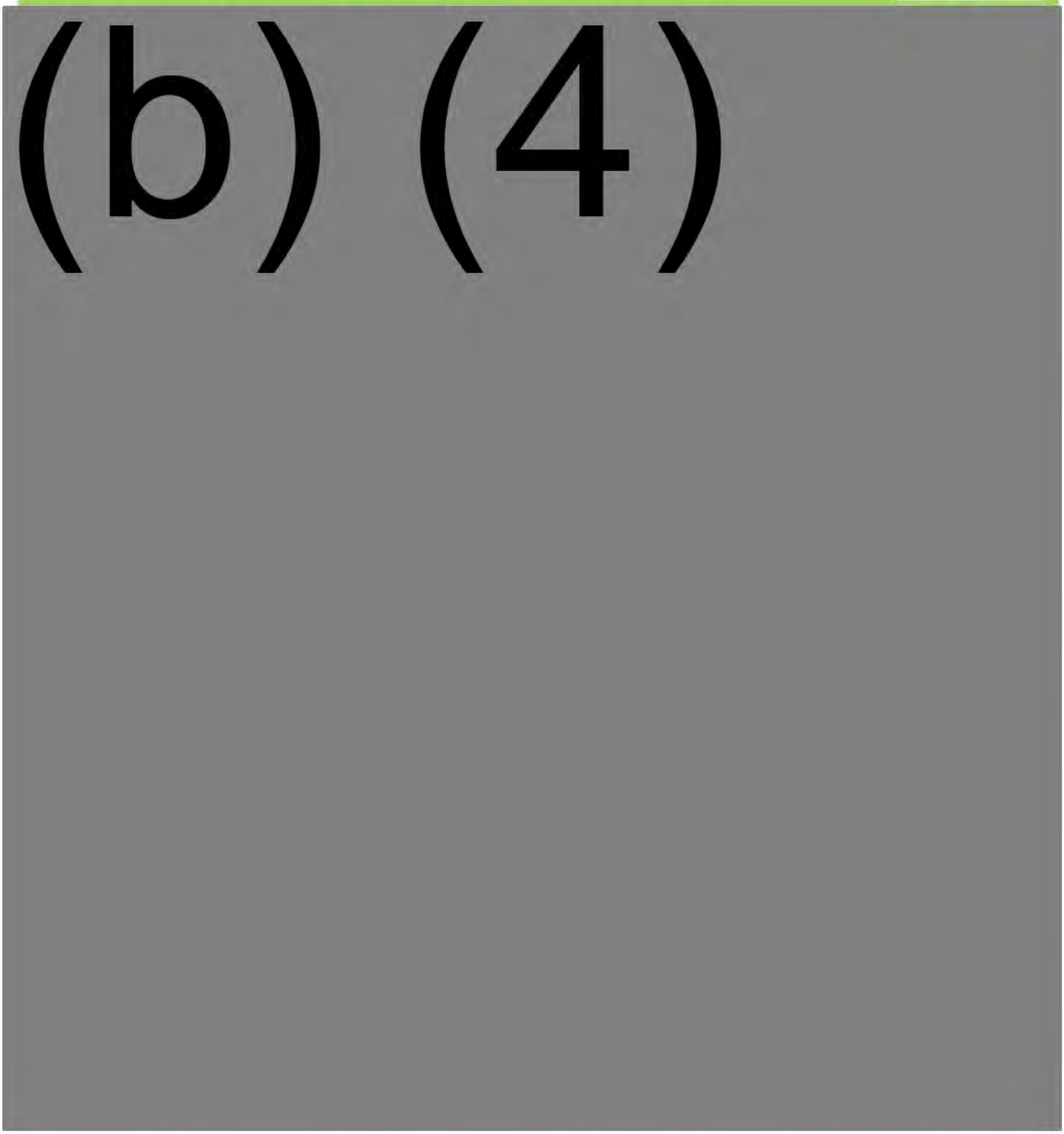
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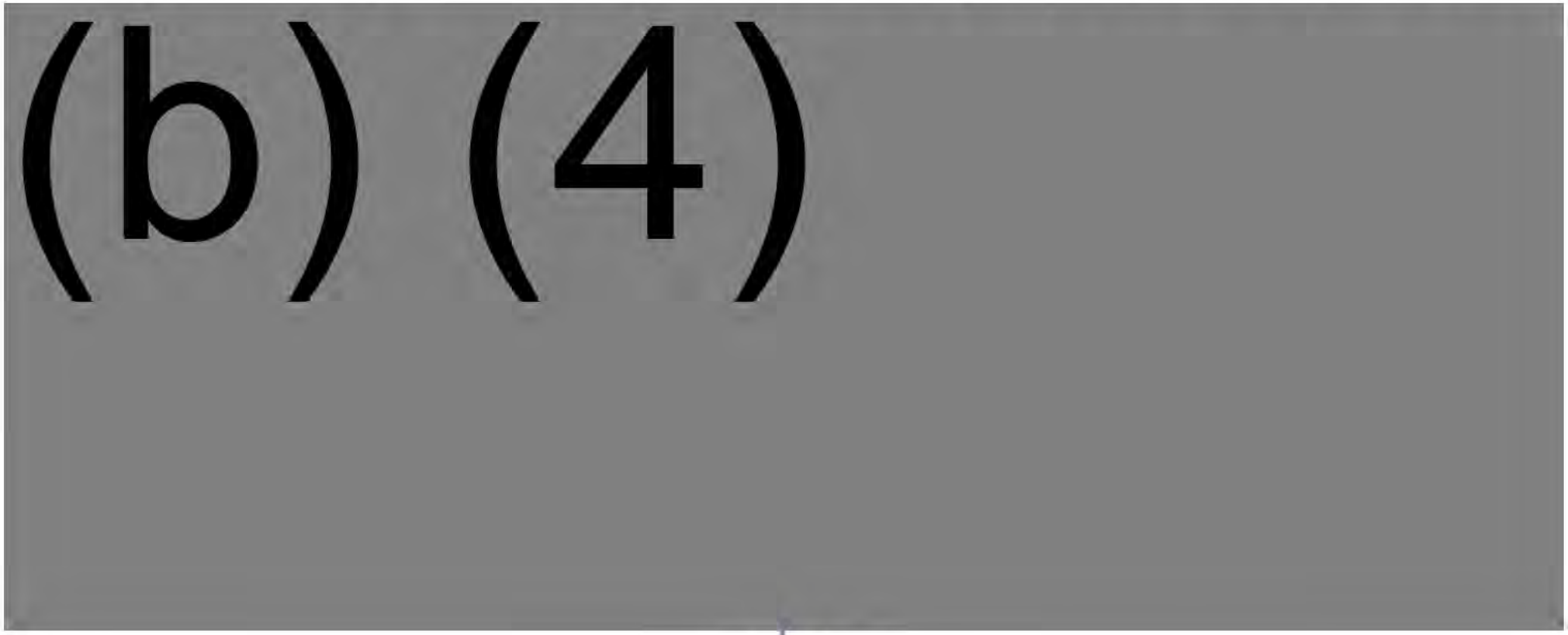
Company Synopsis

AllyAlign Health ("AAH") owns and operates Medicare Advantage Special Needs Plans focused on frail, elderly populations.

AAH transforms the quality of care delivered to geriatric special needs populations by enabling long term care providers to embrace and thrive under value-based care. AAH's proven, turnkey model enables skilled nursing and assisted living facility operators to offset decreasing reimbursement and cost pressures by effectively accepting and managing full risk on the fragile, often dual-eligible, patient populations within their facilities. AAH provides the organizational infrastructure, expertise, clinical protocols and proprietary technology essential to the successful formation and ongoing profitable management of a provider- friendly managed care plan. To establish a new health plan, either 1) forms a joint venture with long-term care providers or 2) wholly owns the plan and manages value based contracts with key providers. AAH's proven technology platform streamlines and coordinates every aspect of care to remove the administrative burdens associated with managed care delivery.

The AAH value proposition is unprecedented in its ability to transform both the quality of care and economic viability of long-term care providers. AllyAlign has a national presence and supports a portfolio of Medicare Advantage Special Needs Plans in 22 states representing over 14,600 lives (> $300m in premium from CMS).



(b) (4)

FW: Study identifies 275 ways to reduce spread of coronavirus following lockdown

From: "Droegemeier, Kelvin K. EOP/OSTP" (b) (6)

To: "Kjelland, Christin C. EOP/OSTP" (b) (6)

Date: Wed, 15 Apr 2020 17:15:46 -0400

Attachments: Piece for policy makersSMC.pdf (68.58 kB); Covid 19 options SMC.pdf (531.77 kB)

Hi Christin,

(b) (5)

Thanks!

Kelvin

From: Mark Ferguson (b) (6)
Sent: Wednesday, April 15, 2020 4:43 PM
To: Droegemeier, Kelvin K. EOP/OSTP (b) (6) Kjelland, Christin C. EOP/OSTP (b) (6)
Subject: [EXTERNAL] Fwd: Study identifies 275 ways to reduce spread of coronavirus following lockdown

Dear Kelvin
The attached from Bill is really useful . Prof Bill Sutherland of the UNIVERSITY OF CAMBRIDGE is a world leader in evidence synthesis - you may have met him at the DUBLIN meeting last year .
Kind Regards
Mark

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Study identifies 275 ways to reduce spread of coronavirus following lockdown

Phased re-opening of schools, businesses and open spaces should be considered alongside a range of practical ways to keep people physically apart, say the authors of a new study on how lockdown can be eased without a resurgence of coronavirus infections.

The study identified 275 ways to reduce transmission of the coronavirus. Medical possibilities were not considered. It does not offer recommendations: a shortlist of the most appropriate options for specific regions and contexts should be considered in the context of their likely effectiveness, cost, practicality and fairness.

"There's increasing pressure to re-open the economy and get people back to work and out of isolation. But if we return to operating as we did before the pandemic, there will be a second wave of the virus. All activities will need to be considered individually, and phased back in carefully, depending on the risk they pose to spreading the virus," said Professor William Sutherland in the University of Cambridge's Department of Zoology, who led the study.

Strict lockdown measures are proving to be effective in controlling the spread of coronavirus in many countries, but are putting a major strain on the population's mental and physical health, and on the economy. Mass vaccination is not likely before the second half of 2021. Measures such as physical distancing, enhancing personal hygiene and reducing contamination are likely to remain central elements of all control strategies for some time.

The study, which has not been peer reviewed, lists the range of practical options available to achieve these measures, including:

- Café owners could open outdoor areas only at first, and wipe down tables - spaced well apart - after each customer.

- Access to public parks could be restricted to different age groups at different times of day, with gates left open so they don't need to be touched, and users asked to walk on the right side of the pavement or clockwise around large open spaces.

- Petrol stations could become fully contactless, with attendants serving customers who pay from inside their car.

- Patients with doctors' appointments could be asked to wait in their car outside the surgery until called in.

- School classes could be split into smaller groups with dedicated teachers, who only go into school one week in every three.

"It's basically about how to stop people hanging around together, and phasing in activities starting with the ones that are the safest. Making this happen will be up to the people responsible for every element of society," says Sutherland.

Identifying, assessing and applying a wide range of options could enable some of the stricter lockdown conditions to be lifted earlier, and make the transition period shorter, say the researchers. The ultimate aim of a successful transition is to achieve 'Resilient Normality' - a new way of existing in the world that makes us less susceptible to future pandemics.

Information was gathered by a method called Solution Scanning, which uses a wide range of sources to identify a range of options for a given problem. Sources included experts in a variety of fields, crowdsourcing on social media, and published research.

"In starting a process of decision-making or guidance-production, it's sensible to be aware of the range of possible options. Policy makers and practitioners must decide which strategies are appropriate to phase in at different stages of the transition from lockdown," said Sutherland.

The list of potential options is available online at >https://covid-19.biorisc.com<

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Reference (preprint)

Sutherland, W.J. et al: 'Informing management of lockdowns and a phased return to normality: a Solution Scan of non-pharmaceutical options to reduce SARS-CoV-2 transmission.' 2020. DOI: 10.17605/OSF.IO/CA5RH

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Informing management of lockdowns and a phased return to normality: a Solution Scan of non-pharmaceutical options to reduce SARS-CoV-2 transmission

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SUMMARY
Two major debates concerning the SARS-CoV-2 coronavirus are (a) how to make "lockdown" (stringent constraints of physical isolation) effective for controlling the spread of the virus, whilst minimising impacts on the economy, society and people's mental and physical health, and (b) how to achieve the transition from lockdown to more normal conditions. There are two parallel components to the transition from lockdown: "Phased Transition" where stringent conditions are relaxed at different rates (e.g. between different regions, age groups or socio-economic activities) and "Responsible Transition" where society devises and delivers actions that reduce transmission risk thereby enabling the softening of stringent measures.

To help deliver a Responsible Transition, we applied Solution Scanning, which uses a wide range of sources to identify a range of options for a given problem. We applied this method by reading, consulting experts in different fields and crowdsourcing using social media. We identified 273 options to reduce SARS-CoV-2 transmission. So, for example, the 127 options for increasing physical isolation include possibilities for creating more space, limiting intergroup mixing, reducing congestion and reducing counterflow interactions. We then challenge society to take seriously the devising of a range of risk reducing strategies for shops, public buildings, nature reserves, tourist locations etc. The decision for policy makers is then to decide which strategies are appropriate to phase in at different stages in the transition.

We recommend a process of identifying which options from this long list of options are relevant and practical for testing, reviewing and assessment in order to provide context-specific guidance. We hope that this paper will encourage the identification of further options and modifications, e.g. through biorisc@caths.cam.ac.uk, and have created a means, https://covid-19.biorisc.com, for updating this list.

The potential gains from identifying, assessing and applying a wider range of options include a) the possible earlier lifting of some of the stringent conditions of lockdown, b) a shorter transition period as more activities come out of lockdown but in a Responsible Transition, and c) a better-informed discussion on the final objective of Resilient Normality, a world in which we are less susceptible to future pandemics.

INTRODUCTION

Stringent physical isolation, or lockdown, appears to be a successful strategy for reducing the spread of SARS-CoV-2 across many countries (Flaxman et al. 2020; Ji et al. 2020; Tian et al. 2020). There is considerable discussion about what to do in the future with increasing political pressure to re-open the economy and get people back to work and out of isolation (Cohen & Kupferschmidt 2020). How can this be done safely, minimizing the risk of a COVID-19 bounceback (Xu & Li 2020)? Mass vaccination is not likely before the second half of 2021 (Gallagher 2020).

One component, under wide consideration and early-stage implementation, is a Phased Transition: stringent conditions relaxed at different rates (e.g. between different regions, age groups or socio-economic activities). This approach was adopted in China, where different cities have imposed different times to return to work or school. In some countries lifting lockdown at different rates in different regions may be politically unpalatable, but phasing in different activities (e.g. business, schools, tourism, universities) may be acceptable. Another component, which we concentrate on here, is Responsible Transition: societal actions that reduce transmission risk, enabling the reduction of the most stringent measures. The target is Resilient Normality, where stringent actions are removed but some actions persist to reduce the vulnerability to COVID-19 infection and to future pandemics (Hollander & Sites 2020).

The decision of when and how to move from lockdown to staged Responsible Transition to Resilient Normality will depend upon observed and predicted disease dynamics and their response to transition, other societal demands (e.g. the economy), herd immunity and vaccines, as well as medical advances to reduce the risk of infection and its consequences, such as new drugs (Alvarez et al. 2020).

Measures to reduce transmission, especially physical distancing, enhancing personal hygiene and reducing contamination, are likely to stay as central elements of strategies for some time. Our single aim in this paper is to explore the range of possible practical societal options for delivering these measures, both to improve their effectiveness under lockdown and especially for a gradual transition to less stringent strategies.

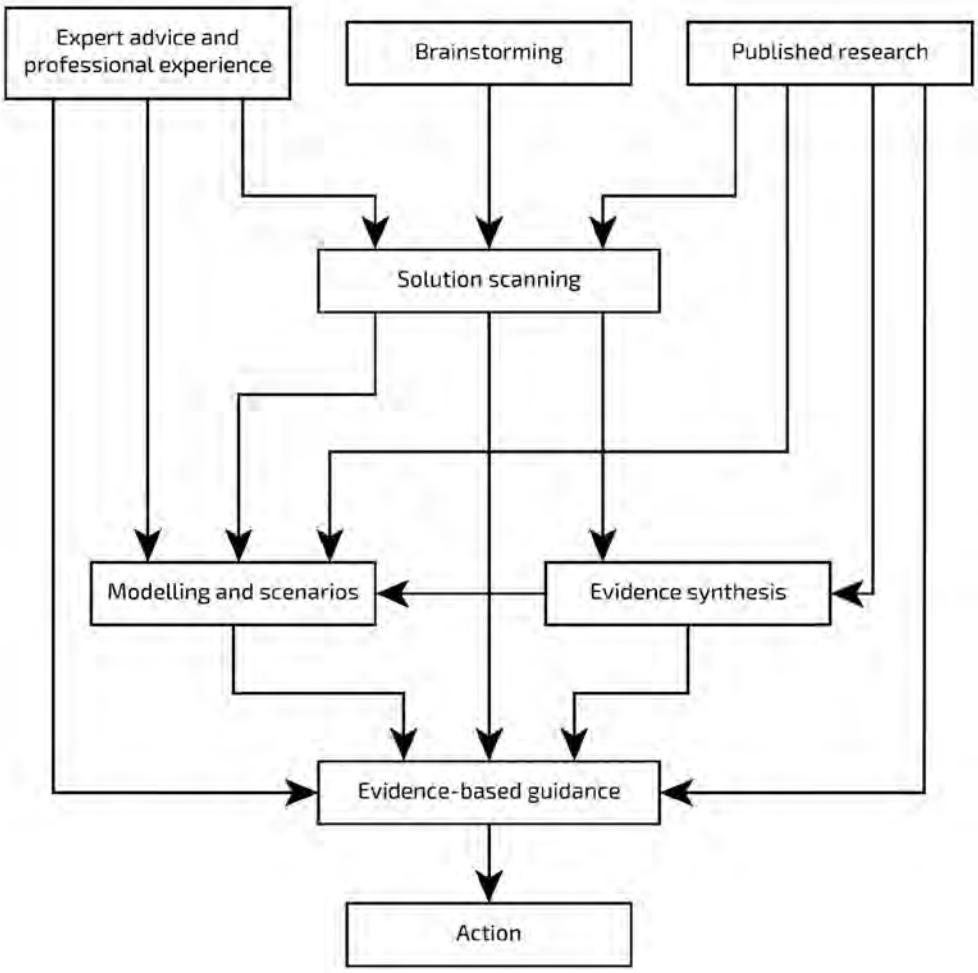

Figure 1. A process for creating evidence-based guidance. Solution scanning is an initial stage for generating options for consideration. The guidance and practice should be based on evidence of risks and effectiveness, ideally with a systematic review, and models to determine the overall strategy. Action should ideally lead to further testing.

Figure 1 shows how effective, evidence-based guidance should be created. In this, a range of sources are used to compile a reasonably comprehensive set of options. Research evidence is rigorously reviewed and models are based on the available evidence. Guidance combines the research with values, knowledge and experience to provide the information needed for appropriate action.

Solution Scanning

The process of Solution Scanning uses published research, existing guidance, the experience of experts and practitioners, and brainstorming (including crowdsourcing) to identify a range of possible options. Previous solution scans include options to maintain or

enhance ecosystem services (Sutherland et al. 2014), options for the conservation of marine biodiversity (Jacquet et al. 2011) and as an initial stage in the process of subject-wide evidence synthesis (Sutherland 2019), as used to assess the effectiveness of conservation options (Sutherland et al. 2019). As shown in Figure 1, the Solution Scan can be used as a source of ideas for experimental testing, reviews or, with expert assessment, guidance for practice. If options are adopted, this may lead to feedback on the practicality or effectiveness of practices. The need for Solution Scanning is illustrated in a study by Walsh et al. (2014), who showed that conservation practitioners responsible for addressing a problem were only aware of 57% of the possible options. In starting a process of decision making or guidance production, it seems sensible to be aware of the range of possible options.

Applying options in making decisions

To illustrate how our Solution Scan might be used, we consider an example. Some popular destinations, such as parks in London, were closed in spring 2020 because they were too congested and physical distancing was impossible. Such a high-risk environment is unlikely to be reopened until the risk of person-to-person viral transmission is negligible. Thus, it is worth considering how risks can be reduced so earlier opening can be considered. Possible measures include walking on the right-hand side of the pavement, walking around clockwise, hands-free gate operation, separate entry and exit points, time slots for different social groups (e.g. adults with one child, retired people, child-free adults etc.) and maximum use times (e.g. can only walk round once and no sitting down). If these measures prove successful in achieving distancing then some of these constraints might be lifted, especially as the transition progresses. The solution scan provides decision-makers with a comprehensive list of such options, the effectiveness and implications of which can be assessed, ultimately feeding into evidence-based guidance (Figure 1).

Practice should be based on the evidence of its effectiveness. For example tests of "nudging" have shown that some intuitively sensible approaches are effective, but others are not (Kosters et al. 2015). Testing of options, such as the effectiveness of different means of marking out spacing (e.g. grids, spots) in delivering physical spacing, is important. Ideally decisions should be based on systematic reviews of evidence—as being done by the Oxford COVID-19 Evidence Service (https://www.cebm.net/oxford-covid-19/) or listed in the Cochrane Library (https://www.cochranelibrary.com/covid-19).

In the absence of a collated body of evidence testing practical options, there is a need to make pragmatic decisions. For example, supermarkets, faced with the clear evidence-based advice to reduce physical spacing and the evidence on the increased risk to certain groups, applied a series of measures including one-way systems that still allow short-cuts, markings on floor to encourage spacing, maximum numbers of customers in store, home deliveries left at the front door in plastic bags rather than unpacked inside,

targeting home delivery to certain groups, and restricting the first hour on certain days to vulnerable groups and carers. Where evidence of the effectiveness of specific options is lacking, but there is a need to act urgently, we consider this approach to be highly appropriate. These measures can surely be improved, ideally by testing, but also by the sharing of implementation experience and inventing means of improving procedures, as done in this epidemic for clinical practice (e.g. Yuan & Zhang 2020). Five examples of questions surrounding the implementation of these measures would be: does trust work when specifying specific shopping hours for vulnerable groups or is identification needed? Are markings sufficient for a one-way system or are barriers also essential? Are boxes or dots better for creating isolation in queues? Do people in queues now isolate automatically without markings? How can the usual one-way system design be improved?

In considering non-pharmaceutical options to reduce transmission of SARS-CoV-2 we specifically do not consider medical options (such as testing, drugs, vaccines or design of face masks) or means of mitigating the wider impact of these options. We also do not consider means of preventing the onset of new pandemics like COVID-19 (but in a separate piece underway we will consider the options for reducing the risk of further zoonotic epidemics). Our audiences here are those who carry out research, evidence synthesis or devise guidance with the objective of expanding the range of non-clinical options for reducing human-to-human transmission of SARS-CoV-2. Much of our experience is in the UK but we have involved colleagues from around the world. We accept that this is biased and other options may be more appropriate in other contexts globally.

We strongly stress that the list below is a list of options, not recommendations. The decision on which options to use will depend upon the overall strategy (such as whether to lighten the restrictions on leaving the house), the identification of the relative risks (such as meeting inside or touching shared items) and the practicality, likely effectiveness, and off-target consequences of the possible options.

We emphasise that we do not consider the off-target consequences of these options. For example, many of these options will have devastating economic consequences, many will have serious health and social consequences (e.g. increasing isolation has mental and physical health implications), civil rights (e.g. contact tracing through phone use), or environmental consequences (e.g. converting to disposable utensils for eating or discouraging use of public transport). Our options are also centred around reducing transmission and should be weighed against other factors (e.g. encouraging people to reduce the number of shopping trips through 'minimum spends' while simultaneously discouraging stockpiling or panic-buying). It may be sensible to reconsider options once lockdown is lightened (for example, the maximum contactless payment limit may be reduced when social mixing returns and card theft increases).

Effective Solution Scans need to be inclusive: we note that many options may not be appropriate for everyone, and in particular for those who are socially, medically or economically vulnerable, employed in a critical sector of the economy, have significant caring responsibilities, are improperly housed, experience non-COVID-19 medical

emergencies, including mental health emergencies, during the pandemic, or are the subject of social, economic or criminal injustices. In particular, groups facing food insecurity will need to be considered a priority in any intervention. The list does not resolve these complexities and we urge policy makers to consider vulnerable groups at every stage.

We wish to make three general points about the listed options. Firstly, options are best focussed where there appears to be a genuine problem. As examples, person-to-person transmission appears critical in this current pandemic, suggesting it is sensible to focus measures where individuals are close together, especially in enclosed spaces, while measures dealing with contamination should focus on widely shared items, such as door handles (e.g. Kurgat et al. 2019). Secondly, achieving broad consensus, for example on expected behaviour in shops would, no doubt, ease the adoption of measures: this is illustrated in the wide acceptance in many countries of rules for social distancing (2 metres, or 6 feet, in the UK). Thirdly, in deciding whether to apply options, much depends on the ability to devise systems that are likely to generate sufficient compliance to be justifiable.

Some of these options also apply to reduce SARS-CoV-2 transmission during lockdown conditions. Furthermore, we also suggest society may wish to consider Resilient Normality: a world in which most elements of normal society are restored but with reduced vulnerability to future diseases (Hollander & Sites 2020). This solution scan could be used to initiate a debate as to what such a world might look like.

METHODS

This work is a collaboration between BioRISC (the Biosecurity Research Initiative at St Catharine's College, Cambridge), Conservation Evidence based in the Department of Zoology, University of Cambridge and the Centre for the Study of Existential Risk. This piece was created by documenting the authors' experience of options, consulting guidance, contacting people working in different countries to explore the range of options and crowd-sourcing ideas through social media. We welcome suggestions for options missed (especially those implemented outside of the UK), innovations for novel options or means of improving existing options. Please contact biorisc@caths.cam.ac.uk. An updated version of the list is available at https://covid-19.biorisc.com.

THE LIST OF OPTIONS

We have identified 273 options to reduce SARS-CoV-2 transmission in five key areas: (1) physical isolation, (2) reducing transmission through contaminated items, (3) enhancing cleaning and hygiene, (4) reducing spread through pets, and (5) restricting disease spread between areas. For any particular problem this long list will quickly be winnowed down to a much shorter list of potential options based on relevance and practicality; this bespoke shortlist will then be the subject of more detailed consideration.

We stress that the listing of an option should not be seen as a recommendation or a

suggestion that it is beneficial. Deciding whether to adopt any of these actions involves policy makers and practitioners considering the evidence for the importance of the transmission risk and likely effectiveness, as well as its cost, practicality and fairness. As our starting point we take the guidance from The Centers for Disease Control and Prevention (CDC; https://www.cdc.gov/).

1. PHYSICAL ISOLATION

It is widely accepted that the main way the virus spreads is transmission through liquid droplets (5 μm or larger) formed through people coughing, and that this is much more likely in close contact (e.g. Bischoff et al. 2013). The risk at greater distances appears much weaker but some studies have shown droplets can travel up to 8 m (Bourouiba 2020). There is uncertainty about the possibility of much longer distance dispersal through aerosols (i.e. droplets smaller than 5 μm), which can disperse further than larger droplets, linger in the air for hours and follow airflow systems. The infectious dose, the number of virus particles required to produce an infection, is unknown (Lewis 2020), which is critical as it determines the risk of low-level exposure. Physical isolation is the central component of government guidance or legislation.

1.1 Reduce physical contact

- Discourage and prohibit physical contact, such as handshaking, kissing or hugging, outside household members/officially listed "bubble" of friends.
- Identify and promote alternative forms of physical contact with a reduced risk of transmission, such as alternative handshakes.

1.2 Self-isolate without external contact

- Self-isolate for a given period if showing symptoms of coronavirus illness.
- Clearly explain the consequences of not self-isolating for self and others.
- Household members self-isolate for a period if one house member shows symptoms.
- Advise older people and vulnerable people to strictly stay at home unless for essential reasons ('shielding').
- Advise people who live with medically vulnerable people to reduce their own movement outside of their house.
- Pay staff to stay at home when infected, showing possible symptoms, or if another household member shows symptoms, to reduce risk of hiding illness at work.
- Recruit and train volunteers to facilitate self-isolation.

1.3 Increase home confinement

- Enforce working from home for all jobs where this is possible.
- Enforce non-working for all non-essential jobs where home working is not possible.
- Develop national registries of essential jobs.
- Fine companies encouraging or forcing non-essential workers to go into work.
- Move lectures and teaching to a home-based setting, for instance via greater use of distance and online learning and self-study.
- Create 'virtual schools' to enable continued education.