OPERATIONAL AMPLIFIER PRACTICE TEST (SAMPLE)

STUDY GUIDE



SAMPLE STUDY GUIDE WITH LIMITED QUESTIONS

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Introduction

Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn't just about memorization, it's about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.

This guide was designed to help you do exactly that.

Whether you're preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You'll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it's correct.

The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It's ideal for learners who want to:

- Practice answering questions under realistic conditions,
- Improve accuracy and speed,
- Review explanations to strengthen weak areas, and
- Approach the exam with greater confidence.

We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.

Remember: successful test preparation isn't about getting every question right the first time, it's about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.

Let's begin.

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How to Use This Guide

This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:

1. Start with a Diagnostic Review

Skim through the questions to get a sense of what you know and what you need to focus on. Your goal is to identify knowledge gaps early.

2. Study in Short, Focused Sessions

Break your study time into manageable blocks (e.g. 30 – 45 minutes). Review a handful of questions, reflect on the explanations.

3. Learn from the Explanations

After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.

4. Track Your Progress

Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.

5. Simulate the Real Exam

Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.

6. Repeat and Review

Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning. Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.

There's no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly, adapt the tips above to fit your pace and learning style. You've got this!

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Questions

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1. With Rf = 50 kΩ and Rin such that the gain magnitude is 10, Rin = 5 kΩ yields a gain of

A. 5

B. 50

C. 100

D. 10

2. If Rin is halved while Rf remains fixed, the closed-loop gain magnitude doubles.

A. It remains unchanged

B. It quadruples

C. It doubles

D. It halves

3. Which circuit illustrates a difference amplifier?

A. Circuit A: A four-resistor differential amplification arrangement

B. Circuit B: Classic four-resistor differential amplifier

C. Circuit C: Non-inverting amplifier configuration

D. Circuit D: Inverting amplifier configuration

4. Which configuration yields a differentiator, and what is the transfer function and a practical limitation?

A. Inverting differentiator with input capacitor Cin and feedback resistor Rf: Vout(s) = - Rf Cin s Vin(s); practical limitation: high-frequency noise and potential instability; stabilization by adding series R or C in feedback

B. Inverting differentiator with input capacitor Cin and feedback capacitor C; Vout(s) = - Cin C s Vin(s)

C. Inverting differentiator with input resistor Rin and capacitor Cf; Vout(s) = - (1/Rin Cf) s Vin(s)

D. Non-inverting differentiator with input capacitor Cin; Vout(s) = Cin s Vin(s)

5. Which statement about a unity-gain buffer is accurate?

A. It inverts the input signal.

B. It scales the input by a factor of 2.

C. It provides a high input impedance but high output impedance.

D. It provides a unity gain, high input impedance, and low output impedance to isolate stages.

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6. Which term describes the error voltage caused by input bias currents?

A. Input bias current

B. Common mode error

C. Voltage gain

D. Output offset voltage

7. Define slew rate and describe its impact on waveform reproduction in high-speed op-amp circuits.

A. Slew rate is the maximum rate of change of the output voltage.

B. Slew rate is the maximum input current the amplifier can handle.

C. Slew rate is the time delay between input and output.

D. Slew rate is the rate at which the op-amp dissipates heat.

8. When would you choose a rail-to-rail input/output op-amp?

A. For high-speed RF designs.

B. For single-supply, low-voltage designs requiring full rail-to-rail swing.

C. When a large output current is required.

D. When low input bias currents are not important.

9. An inverting summing amplifier can be configured to

A. Average several input voltages, apply specific weights to each input as a nulling voltage.

B. Provide a non-inverting gain of two.

C. Filter high-frequency components.

D. Convert DC to AC.

10. Explain the gain-bandwidth product concept and how it governs the closed-loop bandwidth for a given op-amp.

A. GBW varies with frequency and gain.

B. GBW is the product of closed-loop gain and bandwidth and is not constant.

C. GBW is roughly constant; $A_{cl} \times f_{cl} \approx GBW$; as closed-loop gain increases, bandwidth decreases proportionally.

D. GBW equals the ratio of output voltage to input voltage.

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Answers

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1. D
2. C
3. B
4. A
5. D
6. D
7. A
8. B
9. A
10. C

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Explanations

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1. With Rf = 50 kΩ and Rin such that the gain magnitude is 10, Rin = 5 kΩ yields a gain of

A. 5

B. 50

C. 100

D. 10

In an inverting op-amp configuration, the closed-loop gain magnitude is determined by the ratio of the feedback resistor to the input resistor: |A_v| = R_f / R_in. The sign is negative, meaning the output is inverted relative to the input. Here, R_f is 50 kΩ and R_in is 5 kΩ, so the magnitude of the gain is 50/5 = 10. Since the question asks for the gain magnitude, the answer is 10. If you consider the sign, the actual gain is -10, reflecting inversion. The other numerical options don't match the resistor ratio.

2. If Rin is halved while Rf remains fixed, the closed-loop gain magnitude doubles.

A. It remains unchanged

B. It quadruples

C. It doubles

D. It halves

In an inverting op-amp, the closed-loop gain magnitude is set by the ratio Rf/Rin. With an ideal op-amp, Vout = -(Rf/Rin) Vin, so the magnitude is |Vout/Vin| = Rf/Rin. If Rin is halved while Rf stays fixed, the ratio becomes Rf/(Rin/2) = 2(Rf/Rin). Therefore the output amplitude doubles (the sign remains negative, so the output inverts). This is why the gain magnitude doubles when Rin is halved.

3. Which circuit illustrates a difference amplifier?

A. Circuit A: A four-resistor differential amplification arrangement

B. Circuit B: Classic four-resistor differential amplifier

C. Circuit C: Non-inverting amplifier configuration

D. Circuit D: Inverting amplifier configuration

Difference amplifiers are built to take two input voltages and produce an output proportional to their difference. The key is the symmetric four-resistor network around the op-amp: each input is fed through its own resistor, and the feedback and output resistors are paired so that the gains on both inputs match. When the resistor ratios are matched (R1 to R3 equals R2 to R4), the output becomes proportional to the difference of the two inputs, specifically Vout ≈ (R2/R1)·(Vplus − Vminus). This arrangement is what distinguishes a difference amplifier from other common configurations. The other options don't subtract two signals. A non-inverting amplifier takes a single input at the plus terminal and uses a feedback network to set gain, with the minus input influencing the output but not combining a second input signal. An inverting amplifier also uses a single input fed through a resistor into the minus input, with the plus input grounded, producing an inverted, amplified version of that single signal. Only the four-resistor differential arrangement implements the subtraction of two inputs, yielding a differential output.

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4. Which configuration yields a differentiator, and what is the transfer function and a practical limitation?

A. Inverting differentiator with input capacitor Cin and feedback resistor Rf: Vout(s) = - Rf Cin s Vin(s); practical limitation: high-frequency noise and potential instability; stabilization by adding series R or C in feedback

B. Inverting differentiator with input capacitor Cin and feedback capacitor C; Vout(s) = - Cin C s Vin(s)

C. Inverting differentiator with input resistor Rin and capacitor Cf; Vout(s) = -(1/Rin Cf) s Vin(s)

D. Non-inverting differentiator with input capacitor Cin; Vout(s) = Cin s Vin(s)

A differentiator in this op-amp setup comes from the capacitor in the input path and a resistor in the feedback path. With the input capacitor Cin, the input impedance is Z_in = 1/(s Cin); with the feedback resistor Rf, the feedback impedance is Z_f = Rf. The closed-loop gain is Vout/Vin = -Z_f/Z_in = -Rf Cin s. This means the output is proportional to the time derivative of the input, with a gain equal to Rf Cin. A key practical limitation is that the gain increases with frequency, so the circuit boosts high-frequency noise and can become unstable due to the op-amp's finite bandwidth and phase shift. To make it usable, you add stabilization that limits high-frequency gain—for example, a small resistor in series with the input capacitor or a small capacitor in parallel with the feedback resistor—to create a band-limited differentiator that differentiates only over a chosen frequency range.

5. Which statement about a unity-gain buffer is accurate?

A. It inverts the input signal.

B. It scales the input by a factor of 2.

C. It provides a high input impedance but high output impedance.

D. It provides a unity gain, high input impedance, and low output impedance to isolate stages.

A unity-gain buffer, or voltage follower, uses negative feedback to make its output follow the input, giving a gain of about one. Because the op-amp input impedance is very high, it draws almost no current from the source, so the signal isn't loaded. The closed-loop behavior also yields a very low output impedance, so it can drive the next stage without the signal dropping. It does not invert the signal and it does not amplify by a factor of two. So the description of unity gain, high input impedance, and low output impedance to isolate stages is the accurate one.

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6. Which term describes the error voltage caused by input bias currents?

A. Input bias current

B. Common mode error

C. Voltage gain

D. Output offset voltage

The key idea is that real op-amps have input bias currents that flow into or out of the input terminals. When these currents pass through any source resistance, they create small voltage drops at the inputs. Because the amplifier has finite gain with feedback, that input-side error is amplified and shows up as a DC offset at the output. That observable offset at the output, caused by those bias currents, is what we call the output offset voltage. So, while the bias currents themselves are the currents entering the inputs, the specific error you measure at the output due to their effect is the output offset voltage. The other terms don't describe this observable error: the input bias current is the current itself, common-mode error relates to common-mode effects rather than bias-induced output offset, and voltage gain is simply how much the input is amplified, not an error voltage.

7. Define slew rate and describe its impact on waveform reproduction in high-speed op-amp circuits.

A. Slew rate is the maximum rate of change of the output voltage.

B. Slew rate is the maximum input current the amplifier can handle.

C. Slew rate is the time delay between input and output.

D. Slew rate is the rate at which the op-amp dissipates heat.

Slew rate is the maximum rate at which the output voltage can change, usually specified in volts per microsecond. This limit directly governs how well a high-speed op-amp can follow fast input transitions. When you have a signal with large amplitude at high frequency, the required slope of the output, dv/dt, can become large. If that required slope exceeds the op-amp's slew rate, the output can't keep up, and the waveform gets distorted—the edges become rounded or triangular and the amplitude or timing fidelity suffers. For a sine wave, the steepest slope is $2\pi f$ times the peak amplitude, so the condition to avoid distortion is $2\pi fA \leq SR$. This makes the slew rate a primary predictor of how faithfully a fast waveform can be reproduced. The other ideas—input current, a time delay between input and output, or heat dissipation rate—do not define how fast the output can change and thus don't describe the factor that limits waveform fidelity in this context.

8. When would you choose a rail-to-rail input/output op-amp?

A. For high-speed RF designs.

B. For single-supply, low-voltage designs requiring full rail-to-rail swing.

C. When a large output current is required.

D. When low input bias currents are not important.

Rail-to-rail input/output capability means the input can sense signals all the way to the supply rails and the output can swing close to those rails. This is exactly what you need in single-supply, low-voltage designs where the signal range sits near ground and near the positive rail. With a rail-to-rail device, you don't have to provide a negative supply or worry about losing headroom—the input common-mode range and the output swing extend to the rails, giving you the maximum usable dynamic range for your signals and easier interfacing with sensors and ADCs that reference ground. That's why this kind of op-amp is the best choice in those scenarios. In other cases, other constraints dominate: high-speed RF work prioritizes bandwidth and speed rather than rail reach, large output current calls for power or buffer amplifiers, and low input bias current isn't inherently tied to rail-to-rail behavior.

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9. An inverting summing amplifier can be configured to

A. Average several input voltages, apply specific weights to each input as a nulling voltage.

B. Provide a non-inverting gain of two.

C. Filter high-frequency components.

D. Convert DC to AC.

The main idea is that an inverting summing amplifier combines multiple input voltages by summing their currents at the inverting node and converting that total into a single output voltage through the feedback resistor. The output is a weighted sum of the inputs, with the weights set by the ratios of each input resistor to the feedback resistor: Vout = -Rf (V1/R1 + V2/R2 + ... + VN/RN) This means you can average several inputs by choosing equal input resistors and selecting the feedback resistor so that Rf/R equals 1/N. Then Vout becomes -(1/N) times the sum of the inputs, i.e., the average (up to a sign). You can also weight inputs differently simply by picking different input resistors: if you want one input to contribute more, give it a smaller R value relative to the others. The option mentioning a non-inverting gain of two isn't achieved with this basic summing setup, since that would require a different topology. Filtering high-frequency components or DC-to-AC conversion aren't the primary functions of a plain inverting summing amplifier unless additional reactive elements or stages are added.

10. Explain the gain-bandwidth product concept and how it governs the closed-loop bandwidth for a given op-amp.

A. GBW varies with frequency and gain.

B. GBW is the product of closed-loop gain and bandwidth and is not constant.

C. GBW is roughly constant; $A_{cl} \times f_{cl} \approx GBW$; as closed-loop gain increases, bandwidth decreases proportionally.

D. GBW equals the ratio of output voltage to input voltage.

The gain-bandwidth product describes how an op-amp trades gain for speed. Because the internal compensation creates a dominant pole, the open-loop gain falls as frequency increases, so you can't have both high gain and wide bandwidth at the same time. The practical rule is that the closed-loop gain times the closed-loop bandwidth stays roughly constant, equal to the op-amp's GBW (the unity-gain frequency). So, for a given op-amp, the closed-loop bandwidth is about GBW divided by the closed-loop gain: $f_{cl} \approx GBW / A_{cl}$. As you raise the desired closed-loop gain, the bandwidth drops in inverse proportion. This explains why higher closed-loop gains give narrower bandwidths, while lower gains allow wider bandwidths, within the range where the op-amp behaves like a single-pole system. In real devices, there are small variations at very high frequencies or gains due to additional poles, but the described relationship is the standard, useful approximation.

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Next Steps

Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.

As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.

If you need help, have suggestions, or want to share feedback, we'd love to hear from you. Reach out to our team at hello@examzify.com.

Or visit your dedicated course page for more study tools and resources:

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We wish you the very best on your exam journey. You've got this!

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