

OHIO ASSESSMENTS FOR EDUCATORS (OAE) MATHEMATICS PRACTICE EXAM (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.

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!

Questions

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1. Which of the following represents the vector in the direction of the y-axis?
- A. $\vec{k}$ with an arrow over it
 - B. $\vec{j}$ with an arrow over it
 - C. $\vec{i}$ with an arrow over it
 - D. $\vec{m}$ with an arrow over it
2. Which type of function has exactly one output for each input?
- A. Quadratic functions
 - B. Linear functions
 - C. Inverse functions
 - D. Functions in general
3. Which of the following represents the derivative of $\sin^{-1}(u)$?
- A. $\frac{1}{\sqrt{1-u^2}} \frac{du}{dx}$
 - B. $\frac{1}{(1-u^2)} \frac{du}{dx}$
 - C. $\frac{1}{\sqrt{1+u^2}} \frac{du}{dx}$
 - D. $\frac{1}{u\sqrt{1-u^2}} \frac{du}{dx}$
4. In a matrix dilation, what does the factor k represent?
- A. The degree of rotation
 - B. The scale factor applied to the matrix
 - C. The axis over which the matrix is reflected
 - D. The position of the matrix in the coordinate plane
5. Which of the following is NOT a triangle theorem?
- A. SSS
 - B. SSA
 - C. SAS
 - D. AAS
6. What is a concave polygon characterized by?
- A. All diagonals are inside the polygon
 - B. Some diagonals lie outside the polygon
 - C. All sides are equal in length
 - D. All angles are equal

7. What information is derived from random samples of a given size?

- A. Basic Statistics
- B. Experimental Outcomes
- C. Sampling Distribution of the Mean
- D. Control Variables

8. What do you obtain when you integrate $\csc^2(x)dx$?

- A. $-\cot(x)$
- B. $\sec(x)$
- C. $\csc(x)$
- D. $\tan(x)$

9. Which formula represents the area of a sector in radians?

- A. $A = \theta\pi r^2/360$
- B. $A = \theta r^2/2$
- C. $A = \pi r^2\theta$
- D. $A = \pi r^2/2$

10. What is the integral of $\cos(x)$?

- A. $\sin(x)$
- B. $-\sin(x)$
- C. $\cos(x)$
- D. $-\cos(x)$

Answers

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

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Explanations

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1. Which of the following represents the vector in the direction of the y-axis?

- A. $\hat{k}$ with an arrow over it
- B. $\hat{j}$ with an arrow over it**
- C. $\hat{i}$ with an arrow over it
- D. $\hat{m}$ with an arrow over it

The representation of a vector in the direction of the y-axis is denoted by " $\hat{j}$ " with an arrow over it. In the context of vector notation, " $\hat{i}$," " $\hat{j}$," and " $\hat{k}$ " are commonly used to represent unit vectors along the x-axis, y-axis, and z-axis respectively in three-dimensional space. Here, " $\hat{j}$ " specifically indicates a unit vector that has a magnitude of 1 and points directly upward along the y-axis. This convention helps in easily identifying the direction of vectors when working in a coordinate system, making " $\hat{j}$ " the correct representation for the y-axis direction. Understanding this notation is essential for solving problems that involve vector components in physics and mathematics, particularly when dealing with forces, velocities, and other vector quantities.

2. Which type of function has exactly one output for each input?

- A. Quadratic functions
- B. Linear functions
- C. Inverse functions
- D. Functions in general**

The correct answer is based on the fundamental definition of a function in mathematics. A function is a relation that assigns exactly one output value for each input value. This means that regardless of the type of function, whether it is quadratic, linear, or even inverse, the defining characteristic remains the same: each input corresponds to one and only one output. In general, all types of functions, including those listed, adhere to the principle that they cannot assign more than one output for a given input. This consistency across all function types illustrates that the statement in the question holds true universally for any function categorized as such, making "functions in general" the best choice in this context. The other options, while they describe specific types of functions, do not capture the universal application of the function definition as effectively as the chosen answer.

3. Which of the following represents the derivative of $\sin^{-1}(u)$?

- A. $\frac{1}{\sqrt{1-u^2}} \frac{du}{dx}$**
- B. $\frac{1}{(1-u^2)} \frac{du}{dx}$
- C. $\frac{1}{\sqrt{1+u^2}} \frac{du}{dx}$
- D. $\frac{1}{u\sqrt{1-u^2}} \frac{du}{dx}$

The derivative of the inverse sine function, $\sin^{-1}(u)$, can be derived using implicit differentiation or by referring to standard derivative formulas. The correct representation of this derivative is $\frac{1}{\sqrt{1-u^2}} \frac{du}{dx}$. This reflects the chain rule of differentiation, which indicates that when taking the derivative of a composite function, you also need to multiply by the derivative of the inner function (in this case, $\frac{du}{dx}$). The term $\sqrt{1-u^2}$ serves as the normalization factor that accounts for the range of the inverse sine function. To further clarify why this is the correct choice, the derivative $\frac{1}{\sqrt{1-u^2}}$ arises specifically because the inverse sine function has a domain restricted to the interval $[-1, 1]$. Thus, the term $1-u^2$ ensures that we remain within this boundary when calculating the derivative, as it reflects the characteristics of the unit circle (where u represents $\sin(\theta)$). The other options do not conform to the established derivative for $\sin^{-1}(u)$. For instance, the option involving $\frac{1}{(1-u^2)}$ lacks the necessary square root component and does not correspond to the geometric foundation of the sine function. Similarly, options with $\frac{1}{\sqrt{1+u^2}}$ or $\frac{1}{u\sqrt{1-u^2}}$ are incorrect.

4. In a matrix dilation, what does the factor k represent?

- A. The degree of rotation
- B. The scale factor applied to the matrix**
- C. The axis over which the matrix is reflected
- D. The position of the matrix in the coordinate plane

In the context of matrix dilation, the factor k represents the scale factor that is applied to the matrix. When a matrix is dilated by a factor k , all points in the geometric figure represented by that matrix are either expanded or contracted by the scale factor. If k is greater than 1, the figure is enlarged; if k is between 0 and 1, the figure is reduced in size. Consequently, k directly influences the overall dimensions of the shape depicted by the matrix, making it a crucial element in understanding how dilations affect geometric figures. The other options concern different transformations, such as rotation, reflection, or positioning, which are not relevant to the concept of dilation specifically.

5. Which of the following is NOT a triangle theorem?

- A. SSS
- B. SSA**
- C. SAS
- D. AAS

The option that is determined not to be a triangle theorem is based on the properties and restrictions of triangle congruence criteria. The SSS (Side-Side-Side), SAS (Side-Angle-Side), and AAS (Angle-Angle-Side) criteria are all legitimate theorems used to establish congruence between triangles. In contrast, the SSA (Side-Side-Angle) condition does not guarantee congruence. This is due to the fact that two triangles can satisfy the side-side-angle condition yet not be congruent. An example of this is the "Ambiguous Case," which can occur with the Law of Sines when two different triangles can be constructed with the same dimensions. This lack of assurance makes SSA not a theorem for establishing congruence in triangles. Therefore, the selection of SSA as the option that is not a triangle theorem is based on its inability to consistently provide congruent results, unlike the other criteria which are universally accepted axioms in triangle geometry.

6. What is a concave polygon characterized by?

- A. All diagonals are inside the polygon
- B. Some diagonals lie outside the polygon**
- C. All sides are equal in length
- D. All angles are equal

A concave polygon is characterized by the presence of at least one interior angle that is greater than 180 degrees. This condition causes some diagonals to lie outside the polygon. When you connect non-adjacent vertices in a concave polygon, certain line segments (diagonals) will extend beyond the shape, illustrating the property that distinguishes concave polygons from convex ones, where all diagonals remain entirely within the figure. In contrast, the other characteristics mentioned do not accurately describe concave polygons. For instance, convex polygons have all their diagonals inside the figure, while equilateral polygons have all sides equal, and regular polygons feature all angles equal. Therefore, the defining feature of a concave polygon being that some diagonals extend outside the polygon correctly identifies its unique and distinguishing properties.

7. What information is derived from random samples of a given size?

- A. Basic Statistics
- B. Experimental Outcomes
- C. Sampling Distribution of the Mean**
- D. Control Variables

When taking random samples of a given size, the resulting information leads to the concept of the Sampling Distribution of the Mean. This distribution describes how the means of these random samples would behave if you were to take an infinite number of samples of that size from the same population. The Central Limit Theorem plays a key role here, as it states that as the sample size increases, the sampling distribution of the mean tends to follow a normal distribution, regardless of the original population's distribution, given that the sample size is sufficiently large (typically $n \geq 30$ is considered sufficient). This understanding is critical for inferential statistics, where we make predictions or generalizations about a population based on sample data. For instance, it helps in estimating population parameters and conducting hypothesis testing, ensuring that the conclusions drawn from sample data are statistically valid. In contrast, while Basic Statistics might involve summarizing data or calculating averages, it does not specifically encompass the behavior and characteristics of means from random samples. Experimental Outcomes refer to results from conducting experiments rather than information derived from sampling distributions. Control Variables are factors kept constant to ensure that an experiment tests only the effects of the independent variable, which is also not directly relevant to sampling distributions.

8. What do you obtain when you integrate $\csc^2(x)dx$?

- A. $-\cot(x)$**
- B. $\sec(x)$
- C. $\csc(x)$
- D. $\tan(x)$

When integrating the function $\csc^2(x)$, the result is derived from the relationship between the trigonometric functions involved. The integral of $\csc^2(x)$ is specifically tied to the derivative of $\cot(x)$. The derivative of $\cot(x)$ is $-\csc^2(x)$. Therefore, when you perform the integration of $\csc^2(x)$, you're essentially reversing the differentiation process, which introduces a negative sign. This leads to the integral $\int \csc^2(x) dx = -\cot(x) + C$, where C is the constant of integration. The other choices relate to different trigonometric integrals: the integral of $\sec^2(x)$ yields $\tan(x)$, the integral of $\csc(x)$ yields $-\ln|\csc(x) + \cot(x)| + C$, and none of these integrations yield $-\cot(x)$. Thus, the correct integral of $\csc^2(x)$ supports the choice of $-\cot(x)$ as

9. Which formula represents the area of a sector in radians?

A. $A = \theta\pi r^2/360$

B. $A = \theta r^2/2$

C. $A = \pi r^2\theta$

D. $A = \pi r^2/2$

The area of a sector of a circle is calculated using the formula $A = (\theta/2) * r^2$, which can also be expressed as $A = \theta r^2/2$ when θ is measured in radians. Here, r represents the radius of the circle, and θ is the angle in radians that subtends the sector. This formula derives from the fact that a full circle, which measures 2π radians, has an area of πr^2 . Therefore, when you take a fraction of the circle (the sector), the area of that sector is proportional to the fraction of the angle θ compared to the full angle of 2π . By representing the sector's area directly as a function of the angle in radians, the formula correctly relates the size of the sector to both its angle and radius. Other choices may involve measurements or formulas that correspond to different contexts or angles (such as degrees) but do not effectively convey the relationship needed for calculating the area of a sector when using radians.

10. What is the integral of $\cos(x)$?

A. $\sin(x)$

B. $-\sin(x)$

C. $\cos(x)$

D. $-\cos(x)$

The integral of $\cos(x)$ with respect to x is indeed $\sin(x)$, which aligns with what you're referring to as the correct answer. When performing integration, the function's behavior and properties come into play. The cosine function is an even function, meaning it is symmetric about the y -axis, and it integrates to the sine function. This relationship arises from the fundamental concepts of differentiation and integration: the derivative of $\sin(x)$ is $\cos(x)$. Thus, integrating $\cos(x)$ leads to the original function that, when differentiated, yields $\cos(x)$. In summary, the process of finding the integral of $\cos(x)$ hinges on understanding the fundamental relationships between trigonometric functions, particularly how sine and cosine derivatives are linked, ultimately leading to the conclusion that the integral is $\sin(x)$.

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:

<https://oae-mathematics.examzify.com>

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

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