

50 multiple-choice questions

Question 1 (Level 1) — *Translation right*

The graph of $y = x^2$ is translated 3 units to the right. What is the new equation?

- (A) $y = (x - 3)^2$
- (B) $y = (x + 3)^2$
- (C) $y = x^2 - 3$
- (D) $y = x^2 + 3$

Question 2 (Level 1) — *Translation up*

The graph of $y = x^2$ is translated 5 units up. What is the new equation?

- (A) $y = x^2 + 5$
- (B) $y = x^2 - 5$
- (C) $y = (x + 5)^2$
- (D) $y = (x - 5)^2$

Question 3 (Level 1) — *Reflection in x-axis*

The graph of $y = x^2$ is reflected in the x -axis. What is the new equation?

- (A) $y = -x^2$
- (B) $y = (-x)^2$
- (C) $y = x^{-2}$
- (D) $y = \frac{1}{x^2}$

Question 4 (Level 1) — *Identify translation*

The graph of $y = x^2$ becomes $y = x^2 - 4$. What transformation occurred?

- (A) Translated 4 units down
- (B) Translated 4 units up
- (C) Translated 4 units left
- (D) Translated 4 units right

Question 5 (Level 1) — *Translation left*

The graph of $y = x^2$ is translated 2 units to the left. What is the new equation?

- (A) $y = (x + 2)^2$
- (B) $y = (x - 2)^2$
- (C) $y = x^2 + 2$

- (D) $y = x^2 - 2$

Question 6 (Level 1) — *Effect on a point*

The point $(2, 5)$ is translated 3 units right and 1 unit down. What are its new coordinates?

- (A) $(5, 4)$
- (B) $(5, 6)$
- (C) $(-1, 4)$
- (D) $(5, -4)$

Question 7 (Level 1) — *Reflection in y-axis*

The graph of $y = 2x + 1$ is reflected in the y -axis. What is the new equation?

- (A) $y = -2x + 1$
- (B) $y = -(2x + 1)$
- (C) $y = 2x - 1$
- (D) $y = -2x - 1$

Question 8 (Level 1) — *Vertical stretch identification*

The graph of $y = x^2$ becomes $y = 3x^2$. What transformation is this?

- (A) Dilation by factor 3 from the x -axis
- (B) Translation 3 units up
- (C) Dilation by factor 3 from the y -axis
- (D) Translation 3 units right

Question 9 (Level 1) — *New vertex after translation*

The parabola $y = x^2$ has vertex at $(0, 0)$. After translating 2 right and 1 up, what is the new vertex?

- (A) $(2, 1)$
- (B) $(-2, 1)$
- (C) $(2, -1)$
- (D) $(1, 2)$

Question 10 (Level 1) — *Identify transformation from graph*

The graph of $y = |x|$ becomes $y = |x - 4|$. Describe the transformation.

- (A) Translation 4 units right
- (B) Translation 4 units left

- (C) Translation 4 units up
- (D) Translation 4 units down

Question 11 (Level 2) — *Combined translation*

Write the equation when $y = x^2$ is translated 1 unit left and 3 units down.

- (A) $y = (x + 1)^2 - 3$
- (B) $y = (x - 1)^2 - 3$
- (C) $y = (x + 1)^2 + 3$
- (D) $y = (x - 3)^2 + 1$

Question 12 (Level 2) — *Horizontal dilation*

The graph of $y = f(x)$ is dilated by factor $\frac{1}{2}$ from the y -axis. The new equation is:

- (A) $y = f(2x)$
- (B) $y = 2f(x)$
- (C) $y = f\left(\frac{x}{2}\right)$
- (D) $y = \frac{1}{2}f(x)$

Question 13 (Level 2) — *Reflect then translate*

The graph of $y = x^2$ is reflected in the x -axis then translated 2 units up. What is the equation?

- (A) $y = -x^2 + 2$
- (B) $y = -(x^2 + 2)$
- (C) $y = -x^2 - 2$
- (D) $y = -(x - 2)^2$

Question 14 (Level 2) — *Identify dilation factor*

If $y = f(x)$ becomes $y = f(3x)$, the graph is dilated from the y -axis by what factor?

- (A) $\frac{1}{3}$
- (B) 3
- (C) $\frac{1}{9}$
- (D) 9

Question 15 (Level 2) — *Vertical dilation*

The graph of $y = \sin x$ is dilated by factor 4 from the x -axis. What is the new equation?

- (A) $y = 4 \sin x$
- (B) $y = \sin(4x)$
- (C) $y = \sin x + 4$
- (D) $y = \sin\left(\frac{x}{4}\right)$

Question 16 (Level 2) — *Image of a point under reflection*

The point $(3, -2)$ is reflected in the x -axis. What is the image?

- (A) $(3, 2)$
- (B) $(-3, -2)$
- (C) $(-3, 2)$
- (D) $(3, -2)$

Question 17 (Level 2) — *Translation of*

Write the equation of $y = \sqrt{x}$ after translating 4 units right and 1 unit up.

- (A) $y = \sqrt{x - 4} + 1$
- (B) $y = \sqrt{x + 4} + 1$
- (C) $y = \sqrt{x - 4} - 1$
- (D) $y = \sqrt{x - 1} + 4$

Question 18 (Level 2) — *Effect of*

The transformation $y = f(-x)$ represents:

- (A) Reflection in the y -axis
- (B) Reflection in the x -axis
- (C) Reflection in the line $y = x$
- (D) Rotation 180° about the origin

Question 19 (Level 2) — *Asymptote after translation*

The function $y = \frac{1}{x}$ has a vertical asymptote at $x = 0$. After translating 3 units right, where is the vertical asymptote?

- (A) $x = 3$
- (B) $x = -3$
- (C) $x = 0$
- (D) $y = 3$

Question 20 (Level 2) — *Determine the original function*

If $y = (x - 1)^2 + 4$ was obtained by translating $y = g(x)$ by 1 right and 4 up, what is $g(x)$?

- (A) $g(x) = x^2$
- (B) $g(x) = (x - 1)^2$
- (C) $g(x) = x^2 + 4$
- (D) $g(x) = (x + 1)^2 - 4$

Question 21 (Level 3) — *Combined transformations*

The graph of $y = x^2$ undergoes a dilation by factor 2 from the x -axis, then a translation 1 right and 3 up. What is the equation?

- (A) $y = 2(x - 1)^2 + 3$
- (B) $y = 2(x + 1)^2 + 3$
- (C) $y = 2(x - 1)^2 - 3$
- (D) $y = (2x - 1)^2 + 3$

Question 22 (Level 3) — *Identify transformation sequence*

The function $y = -2(x + 3)^2 + 1$ is obtained from $y = x^2$ by which sequence?

- (A) Reflect in x -axis, dilate vertically by 2, translate 3 left and 1 up
- (B) Reflect in y -axis, dilate vertically by 2, translate 3 right and 1 up
- (C) Dilate vertically by 2, translate 3 left and 1 down
- (D) Reflect in x -axis, dilate horizontally by 2, translate 3 left and 1 up

Question 23 (Level 3) — *Transformation of*

Write the equation of $y = \frac{1}{x}$ after translating 2 right and 1 down.

- (A) $y = \frac{1}{x-2} - 1$
- (B) $y = \frac{1}{x+2} - 1$
- (C) $y = \frac{1}{x-2} + 1$
- (D) $y = \frac{1}{x-1} - 2$

Question 24 (Level 3) — *Image of a point under dilation*

The point $(4, 6)$ undergoes a dilation by factor 3 from the x -axis and factor $\frac{1}{2}$ from the y -axis. What is the image?

- (A) $(2, 18)$
- (B) $(12, 3)$

- (C) (2, 2)
- (D) (12, 18)

Question 25 (Level 3) — *Function notation for transformations*

If $f(x) = x^2$, write $f(x - 2) + 3$ in expanded form.

- (A) $x^2 - 4x + 7$
- (B) $x^2 - 4x + 1$
- (C) $x^2 + 4x + 7$
- (D) $x^2 - 2x + 7$

Question 26 (Level 3) — *Transformation of sine*

The graph of $y = \sin x$ undergoes a dilation by factor $\frac{1}{3}$ from the y -axis. What is the new equation?

- (A) $y = \sin(3x)$
- (B) $y = 3 \sin x$
- (C) $y = \sin\left(\frac{x}{3}\right)$
- (D) $y = \frac{1}{3} \sin x$

Question 27 (Level 3) — *Reflection in*

The point (3, 7) is reflected in the line $y = x$. What is the image?

- (A) (7, 3)
- (B) (-3, -7)
- (C) (3, -7)
- (D) (-7, -3)

Question 28 (Level 3) — *Order of transformations matters*

Starting with $y = x^2$, applying "translate 1 right then dilate by 2 from the y -axis" gives a different result than "dilate then translate". What equation results from translate first, then dilate?

- (A) $y = \left(\frac{x}{2} - 1\right)^2$
- (B) $y = \left(\frac{x-1}{2}\right)^2$
- (C) $y = \left(\frac{x}{2} + 1\right)^2$
- (D) $y = 2(x - 1)^2$

Question 29 (Level 3) — *Effect on asymptotes*

The function $y = 2^x$ has asymptote $y = 0$. After a reflection in the x -axis and translation 5 up, what is the new asymptote?

- (A) $y = 5$
- (B) $y = -5$
- (C) $y = 0$
- (D) $x = 5$

Question 30 (Level 3) — *Inverse as reflection*

The graph of $y = 2^x$ is reflected in the line $y = x$. What is the equation of the image?

- (A) $y = \log_2 x$
- (B) $y = 2^{-x}$
- (C) $y = -2^x$
- (D) $y = x^2$

Question 31 (Level 4) — *Transformation in function notation*

If $g(x) = f(2(x - 1)) + 3$, describe the transformations applied to $f(x)$.

- (A) Dilate by $\frac{1}{2}$ from y -axis, translate 1 right and 3 up
- (B) Dilate by 2 from y -axis, translate 1 right and 3 up
- (C) Dilate by $\frac{1}{2}$ from y -axis, translate 1 left and 3 up
- (D) Dilate by 2 from x -axis, translate 2 right and 3 up

Question 32 (Level 4) — *Matrix for reflection*

Which matrix represents a reflection in the y -axis?

- (A) $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$
- (B) $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
- (C) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$
- (D) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

Question 33 (Level 4) — *Matrix for dilation*

Write the matrix for a dilation of factor 3 from the y -axis and factor 2 from the x -axis.

(A) $\begin{pmatrix} 3 & 0 \\ 0 & 2 \end{pmatrix}$

(B) $\begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix}$

(C) $\begin{pmatrix} \frac{1}{3} & 0 \\ 0 & \frac{1}{2} \end{pmatrix}$

(D) $\begin{pmatrix} 3 & 2 \\ 0 & 0 \end{pmatrix}$

Question 34 (Level 4) — *Find rule from transformed graph*

The graph of $y = \frac{1}{x}$ is transformed to have asymptotes at $x = 2$ and $y = -1$. What is the equation?

(A) $y = \frac{1}{x-2} - 1$

(B) $y = \frac{1}{x+2} - 1$

(C) $y = \frac{-1}{x-2} + 1$

(D) $y = \frac{1}{x-2} + 1$

Question 35 (Level 4) — *Transform exponential*

The graph of $y = e^x$ is dilated by factor 2 from the x -axis, reflected in the y -axis, then translated 1 up. Write the equation.

(A) $y = 2e^{-x} + 1$

(B) $y = -2e^x + 1$

(C) $y = 2e^{-(x+1)}$

(D) $y = 2e^{-x} - 1$

Question 36 (Level 4) — *Mapping rule*

Under the transformation $(x, y) \mapsto (2x + 1, 3y - 2)$, find the image of the point $(1, 4)$.

(A) $(3, 10)$

(B) $(3, 14)$

(C) $(2, 10)$

(D) $(1, 10)$

Question 37 (Level 4) — *Find rule given mapping*

Under a transformation, $(x, y) \mapsto \left(\frac{x}{2}, -y + 3\right)$. If the original curve is $y = x^2$, find the equation of the image.

(A) $y = -4x^2 + 3$

- (B) $y = 4x^2 + 3$
(C) $y = -\frac{x^2}{4} + 3$
(D) $y = -4x^2 - 3$

Question 38 (Level 4) — *Period after dilation*

The function $y = \cos x$ has period 2π . After a dilation by factor $\frac{1}{4}$ from the y -axis, what is the new period?

- (A) $\frac{\pi}{2}$
(B) 8π
(C) $\frac{\pi}{4}$
(D) 4π

Question 39 (Level 4) — *Transform log function*

The graph of $y = \ln x$ is dilated by factor 2 from the y -axis and translated 3 down. What is the equation?

- (A) $y = \ln\left(\frac{x}{2}\right) - 3$
(B) $y = \ln(2x) - 3$
(C) $y = 2\ln x - 3$
(D) $y = \ln\left(\frac{x}{2}\right) + 3$

Question 40 (Level 4) — *Domain change under dilation*

If $f : [0, 4] \rightarrow \mathbb{R}$, $f(x) = x^2$, and a dilation by factor 3 from the y -axis is applied, what is the new domain?

- (A) $[0, 12]$
(B) $[0, \frac{4}{3}]$
(C) $[0, 4]$
(D) $[0, 16]$

Question 41 (Level 5) — *Composite transformation matrix*

Find the single matrix for: reflect in the x -axis, then dilate by factor 2 from the y -axis.

- (A) $\begin{pmatrix} 2 & 0 \\ 0 & -1 \end{pmatrix}$
(B) $\begin{pmatrix} -2 & 0 \\ 0 & 1 \end{pmatrix}$
(C) $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$

(D) $\begin{pmatrix} -1 & 0 \\ 0 & 2 \end{pmatrix}$

Question 42 (Level 5) — *Find original from image*

The image of $y = f(x)$ under $(x, y) \mapsto (x + 2, 3y)$ is $y = 6(x - 2)^2$. Find $f(x)$.

- (A) $f(x) = 2x^2$
- (B) $f(x) = 6x^2$
- (C) $f(x) = 2(x - 2)^2$
- (D) $f(x) = 18x^2$

Question 43 (Level 5) — *Self-inverse transformation*

For which value of k is the transformation $(x, y) \mapsto (kx, ky)$ self-inverse (applying it twice returns the original point)?

- (A) $k = -1$
- (B) $k = 0$
- (C) $k = 2$
- (D) $k = \frac{1}{2}$

Question 44 (Level 5) — *Transform then find area*

The region bounded by $y = x^2$, $x = 0$, and $x = 1$ has area $\frac{1}{3}$. Under a dilation by factor 2 from the y -axis and factor 3 from the x -axis, what is the area of the image?

- (A) 2
- (B) 6
- (C) $\frac{1}{6}$
- (D) $\frac{2}{3}$

Question 45 (Level 5) — *Transformation to map one curve to another*

Find the transformations that map $y = x^2$ to $y = 4 - (x + 1)^2$.

- (A) Reflect in x -axis, translate 1 left and 4 up
- (B) Reflect in y -axis, translate 1 right and 4 up
- (C) Reflect in x -axis, translate 1 right and 4 down
- (D) Dilate by 4 from x -axis, translate 1 left

Question 46 (Level 5) — *Image equation from matrix + translation*

Under the transformation $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 0 \\ 5 \end{pmatrix}$, find the image of $y = \sqrt{x}$.

- (A) $y = 5 - 2\sqrt{x}$
 (B) $y = -2\sqrt{x} - 5$
 (C) $y = 2\sqrt{x} + 5$
 (D) $y = 5 + 2\sqrt{x}$

Question 47 (Level 5) — *Invariant point*

Under the transformation $(x, y) \mapsto (2x - 3, y + 1)$, find the invariant point (a point that maps to itself).

- (A) No invariant point exists
 (B) $(3, 0)$
 (C) $(3, 1)$
 (D) $(0, -1)$

Question 48 (Level 5) — *Composition of transformations*

Let T_1 be a reflection in the x -axis and T_2 be a reflection in the y -axis. What single transformation is $T_2 \circ T_1$?

- (A) Rotation 180° about the origin
 (B) Reflection in the line $y = x$
 (C) Reflection in the line $y = -x$
 (D) The identity transformation

Question 49 (Level 5) — *Determine transformation from two points*

A linear transformation maps $(1, 0) \mapsto (3, 0)$ and $(0, 1) \mapsto (0, -2)$. Find the transformation matrix.

- (A) $\begin{pmatrix} 3 & 0 \\ 0 & -2 \end{pmatrix}$
 (B) $\begin{pmatrix} 0 & 3 \\ -2 & 0 \end{pmatrix}$
 (C) $\begin{pmatrix} 3 & -2 \\ 0 & 0 \end{pmatrix}$
 (D) $\begin{pmatrix} -2 & 0 \\ 0 & 3 \end{pmatrix}$

Question 50 (Level 5) — *Transformation of a cubic*

The graph of $y = x^3$ is transformed by $(x, y) \mapsto \left(\frac{x}{2}, -y + 4\right)$. Find the equation of the image.

- (A) $y = -8x^3 + 4$
- (B) $y = 8x^3 + 4$
- (C) $y = -\frac{x^3}{8} + 4$
- (D) $y = -8x^3 - 4$

Solutions

Q1: (A)

Replace x with $(x - 3)$: $y = (x - 3)^2$.

Q2: (A)

$$y = x^2 + 5.$$

Q3: (A)

$$y = -x^2.$$

Q4: (A)

The graph was translated 4 units down.

Q5: (A)

$$y = (x + 2)^2.$$

Q6: (A)

$$(2 + 3, 5 - 1) = (5, 4).$$

Q7: (A)

$$y = 2(-x) + 1 = -2x + 1.$$

Q8: (A)

A dilation (stretch) by factor 3 from the x -axis (vertical direction).

Q9: (A)

New vertex: $(0 + 2, 0 + 1) = (2, 1)$.

Q10: (A)

Translation 4 units to the right.

Q11: (A)

$$y = (x + 1)^2 - 3.$$

Q12: (A)

$$y = f(2x).$$

Q13: (A)

$$y = -x^2 + 2.$$

Q14: (A)

Dilation factor $\frac{1}{3}$ from the y -axis.

Q15: (A)

$$y = 4 \sin x.$$

Q16: (A)

$$(3, -(-2)) = (3, 2).$$

Q17: (A)

$$y = \sqrt{x - 4} + 1.$$

Q18: (A)

A reflection in the y -axis.

Q19: (A)

The asymptote moves to $x = 3$.

Q20: (A)

$$g(x) = x^2.$$

Q21: (A)

$$y = 2(x - 1)^2 + 3.$$

Q22: (A)

Reflect in x -axis, dilate by factor 2 from x -axis, translate 3 left and 1 up.

Q23: (A)

$$y = \frac{1}{x-2} - 1.$$

Q24: (A)

$$(4 \times \frac{1}{2}, 6 \times 3) = (2, 18).$$

Q25: (A)

$$f(x-2) + 3 = (x-2)^2 + 3 = x^2 - 4x + 4 + 3 = x^2 - 4x + 7.$$

Q26: (A)

$$y = \sin(3x).$$

Q27: (A)Image: $(7, 3)$.**Q28:** (A)

$$y = \left(\frac{x}{2} - 1\right)^2.$$

Q29: (A)New asymptote: $y = 5$.**Q30:** (A)The inverse of $y = 2^x$ is $y = \log_2 x$.**Q31:** (A)Dilation by factor $\frac{1}{2}$ from the y -axis, translation 1 unit right and 3 units up.**Q32:** (A)

$$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}.$$

Q33: (A)

$$\begin{pmatrix} 3 & 0 \\ 0 & 2 \end{pmatrix}.$$

Q34: (A)

$$y = \frac{1}{x-2} - 1.$$

Q35: (A)

$$y = 2e^{-x} + 1.$$

Q36: (A)Image: $(3, 10)$.**Q37:** (A) $3 - y' = 4x'^2$, so $y' = -4x'^2 + 3$. Image: $y = -4x^2 + 3$.**Q38:** (A)New period = $\frac{2\pi}{4} = \frac{\pi}{2}$.**Q39:** (A)

$$y = \ln\left(\frac{x}{2}\right) - 3 = \ln x - \ln 2 - 3.$$

Q40: (A)New domain: $[0 \times 3, 4 \times 3] = [0, 12]$.**Q41:** (A)

$$\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} = \begin{pmatrix} 2 & 0 \\ 0 & -1 \end{pmatrix}.$$

Q42: (A)Let $u = x' - 2$: $f(u) = 2u^2$, so $f(x) = 2x^2$.**Q43:** (A) $k^2 = 1 \Rightarrow k = 1$ or $k = -1$. Since $k = 1$ is trivial, the non-trivial answer is $k = -1$.**Q44:** (A)Area scale factor = $2 \times 3 = 6$. New area = $\frac{1}{3} \times 6 = 2$.**Q45:** (A)Reflect in the x -axis (multiply y by -1), translate 1 unit left and 4 units up.**Q46:** (A)

$$y' = 5 - 2\sqrt{x'}$$
. Image: $y = 5 - 2\sqrt{x}$.

Q47: (A) $x = 2x - 3 \Rightarrow x = 3$. $y = y + 1 \Rightarrow 0 = 1$: contradiction. There is no invariant point.

Q48: (A)

$(x, y) \mapsto (-x, -y)$, which is a rotation of 180° about the origin.

Q49: (A)

$$\text{Matrix} = \begin{pmatrix} 3 & 0 \\ 0 & -2 \end{pmatrix}.$$

Q50: (A)

$y' = 4 - 8x'^3$. Image: $y = -8x^3 + 4$.