50 multiple-choice questions

Question 1 (Level 1) — *Area under line*
Find the area under $y = 2$ from $x = 0$ to $x = 5$.

(A) 10

(B) 5

(C) 7

(D) 2

Question 2 (Level 1) — *Area of triangle*
Find the area under $y = x$ from $x = 0$ to $x = 4$.

(A) 8

(B) 16

(C) 4

(D) 12

Question 3 (Level 1) — *Area under x*
Find the area under $y = x^2$ from $x = 0$ to $x = 2$.

(A) $\frac{8}{3}$

(B) 4

(C) $\frac{4}{3}$

(D) 8

Question 4 (Level 1) — *Area formula*
The area under a curve $y = f(x)$ (where $f(x) \geq 0$) from $x = a$ to $x = b$ is given by:

(A) $\int_a^b f(x)\,dx$

(B) $f(b) - f(a)$

(C) $\frac{f(a)+f(b)}{2}$

(D) $f'(b) - f'(a)$

Question 5 (Level 1) — *Area under $3x$*
Find the area enclosed between $y = 3x$, the x-axis, $x = 0$ and $x = 2$.

(A) 6

(B) 3

(C) 12

(D) 9

Question 6 (Level 1) — *Trapezoid area*
Find the area under $y = x + 1$ from $x = 0$ to $x = 3$.

(A) $\frac{15}{2}$

(B) 6

(C) 12

(D) $\frac{9}{2}$

Question 7 (Level 1) — *Area under x from 0 to 1*
Find the area under $y = x^2$ from $x = 0$ to $x = 1$.

(A) $\frac{1}{3}$

(B) $\frac{1}{2}$

(C) 1

(D) $\frac{2}{3}$

Question 8 (Level 1) — *Area under 4*
Find the area under $y = 4$ from $x = 1$ to $x = 6$.

(A) 20

(B) 24

(C) 4

(D) 10

Question 9 (Level 1) — *Area under 2x from 1 to 3*
Find the area under $y = 2x$ from $x = 1$ to $x = 3$.

(A) 8

(B) 6

(C) 4

(D) 10

Question 10 (Level 1) — *Area under x*
Find the area under $y = x^3$ from $x = 0$ to $x = 2$.

(A) 4

(B) 8

(C) 2

(D) 16

Question 11 (Level 2) — *Area under parabola*
Find the area enclosed between $y = x^2$ and the x-axis from $x = 0$ to $x = 3$.

(A) 9

(B) 27

(C) 3

(D) $\frac{27}{2}$

Question 12 (Level 2) — *Area between line and x-axis*
Find the area enclosed between $y = 4 - x$, the x-axis, $x = 0$ and $x = 4$.

(A) 8

(B) 16

(C) 4

(D) 12

Question 13 (Level 2) — *Area between two lines*
Find the area between $y = 2x$ and $y = x$ from $x = 0$ to $x = 3$.

(A) $\frac{9}{2}$

(B) 9

(C) 3

(D) $\frac{3}{2}$

Question 14 (Level 2) — *Area under curve below x-axis*
Find the area enclosed between $y = x^2 - 4$ and the x-axis from $x = -2$ to $x = 2$.

(A) $\frac{32}{3}$

(B) $-\frac{32}{3}$

(C) $\frac{16}{3}$

(D) 0

Question 15 (Level 2) — *Area between x and x*
Find the area between $y = x$ and $y = x^2$ from $x = 0$ to $x = 1$.

(A) $\frac{1}{6}$

(B) $\frac{1}{3}$

(C) $\frac{1}{2}$

(D) $\frac{1}{4}$

Question 16 (Level 2) — *Finding intersection*
Where do $y = x$ and $y = x^2$ intersect?

(A) $x = 0$ and $x = 1$

(B) $x = 0$ and $x = 2$

(C) $x = 1$ only

(D) $x = 0$ only

Question 17 (Level 2) — *Area with negative region*
Find the total area between $y = x$ and the x-axis from $x = -2$ to $x = 3$.

(A) $\frac{13}{2}$

(B) $\frac{5}{2}$

(C) 5

(D) $\frac{9}{2}$

Question 18 (Level 2) — *Area under curve shifted up*
Find the area under $y = x^2 + 1$ from $x = 0$ to $x = 2$.

(A) $\frac{14}{3}$

(B) $\frac{8}{3}$

(C) 6

(D) $\frac{10}{3}$

Question 19 (Level 2) — *Simple between curves*
Find the area between $y = 4$ and $y = x^2$ from $x = -2$ to $x = 2$.

(A) $\frac{32}{3}$

(B) 16

(C) $\frac{16}{3}$

(D) 8

Question 20 (Level 2) — *Area under x*
Find the area under $y = \sqrt{x}$ from $x = 0$ to $x = 9$.

(A) 18

(B) 27

(C) 9

(D) 6

Question 21 (Level 3) — *Area between parabolas*
Find the area between $y = x^2$ and $y = 2x - x^2$.

(A) $\frac{1}{3}$

(B) $\frac{2}{3}$

(C) 1

(D) $\frac{1}{6}$

Question 22 (Level 3) — *Area between x and 4-x*
Find the area enclosed between $y = x^2$ and $y = 4 - x^2$.

(A) $\frac{16\sqrt{2}}{3}$

(B) $\frac{8\sqrt{2}}{3}$

(C) 8

(D) $\frac{32}{3}$

Question 23 (Level 3) — *Area under e*
Find the area under $y = e^x$ from $x = 0$ to $x = 2$.

(A) $e^2 - 1$

(B) e^2

(C) $e^2 + 1$

(D) $2e$

Question 24 (Level 3) — *Area between cubic and x-axis*
Find the total area between $y = x^3 - x$ and the x-axis from $x = -1$ to $x = 1$.

(A) $\frac{1}{2}$

(B) 0

(C) $\frac{1}{4}$

(D) 1

Question 25 (Level 3) — *Area between line and parabola*
Find the area between $y = x + 2$ and $y = x^2$.

(A) $\frac{9}{2}$

(B) $\frac{9}{4}$

(C) 3

(D) $\frac{27}{6}$

Question 26 (Level 3) — *Signed vs actual area*
If $\int_0^3 f(x)\,dx = -2$, the area between the curve and the x-axis (if $f(x) \leq 0$ on $[0, 3]$) is:

(A) 2

(B) -2

(C) 0

(D) 4

Question 27 (Level 3) — *Area under sin(x)*
Find the area under one arch of $y = \sin(x)$ (from $x = 0$ to $x = \pi$).

(A) 2

(B) π

(C) 1

(D) 0

Question 28 (Level 3) — *Area bounded by axes*
Find the area enclosed by $y = 4 - x^2$, the x-axis, and the y-axis (first quadrant only).

(A) $\frac{16}{3}$

(B) $\frac{8}{3}$

(C) 8

(D) 4

Question 29 (Level 3) — *Area between x and 2x*
Find the area enclosed between $y = x^2$ and $y = 2x$.

(A) $\frac{4}{3}$

(B) $\frac{8}{3}$

(C) 4

(D) $\frac{2}{3}$

Question 30 (Level 3) — *Area under 1/x*
Find the area under $y = \frac{1}{x}$ from $x = 1$ to $x = e^2$.

(A) 2

(B) e^2

(C) 1

(D) $e^2 - 1$

Question 31 (Level 4) — *Area between e and line*
Find the area between $y = e^x$, $y = 1$, and $x = 1$.

(A) $e - 2$

(B) $e - 1$

(C) e

(D) 1

Question 32 (Level 4) — *Area between sin and cos*
Find the area between $y = \sin(x)$ and $y = \cos(x)$ from $x = 0$ to $x = \frac{\pi}{4}$.

(A) $\sqrt{2} - 1$

(B) $1 - \sqrt{2}$

(C) $\frac{\sqrt{2}}{2}$

(D) 1

Question 33 (Level 4) — *Area between e and e*
Find the area between $y = e^x$ and $y = e^{-x}$ from $x = 0$ to $x = 1$.

(A) $e + \frac{1}{e} - 2$

(B) $e - \frac{1}{e}$

(C) $e - 1$

(D) $2(e - 1)$

Question 34 (Level 4) — *Area with absolute value integral*
Find the total area between $y = x^2 - 1$ and the x-axis from $x = 0$ to $x = 2$.

(A) 2

(B) $\frac{2}{3}$

(C) $\frac{4}{3}$

(D) $\frac{8}{3}$

Question 35 (Level 4) — *Area between cubic and line*
Find the area between $y = x^3$ and $y = x$ for $x \in [0, 1]$.

(A) $\frac{1}{4}$

(B) $\frac{1}{2}$

(C) $\frac{1}{3}$

(D) $\frac{1}{6}$

Question 36 (Level 4) — *Area parameter*
Find $k > 0$ such that the area under $y = e^x$ from 0 to k equals $e^2 - 1$.

(A) 2

(B) e^2

(C) $\ln 2$

(D) e

Question 37 (Level 4) — *Area under y = xe-x*
Find the area under $y = xe^{-x}$ from $x = 0$ to $x = 1$.

(A) $1 - \frac{2}{e}$

(B) $\frac{1}{e}$

(C) $1 - \frac{1}{e}$

(D) $\frac{2}{e}$

Question 38 (Level 4) — *Area between x and x (full)*
Find the total area enclosed between $y = x^3$ and $y = x$.

(A) $\frac{1}{2}$

(B) $\frac{1}{4}$

(C) 1

(D) $\frac{3}{4}$

Question 39 (Level 4) — *Area between sin(x) and x-axis full period*
Find the total area between $y = \sin(x)$ and the x-axis from $x = 0$ to $x = 2\pi$.

(A) 4

(B) 0

(C) 2

(D) 2π

Question 40 (Level 4) — *Area between quadratics*
Find the area between $y = x^2 - 2x$ and $y = -x^2 + 4x$.

(A) 9

(B) 18

(C) $\frac{9}{2}$

(D) 27

Question 41 (Level 5) — *Area between sin and cos full*
Find the area between $y = \sin(x)$ and $y = \cos(x)$ from $x = 0$ to $x = \frac{\pi}{2}$.

(A) $2\sqrt{2} - 2$

(B) $\sqrt{2} - 1$

(C) 2

(D) $2(\sqrt{2} + 1)$

Question 42 (Level 5) — *Area with ln*
Find the area between $y = \ln(x)$ and the x-axis from $x = 1$ to $x = e$.

(A) 1

(B) $e - 1$

(C) e

(D) $\frac{1}{e}$

Question 43 (Level 5) — *Area in terms of parameter*
The area between $y = x^2$ and $y = k$ (where $k > 0$) is $\frac{4k\sqrt{k}}{3}$. Verify for $k = 4$.

(A) $\frac{32}{3}$

(B) $\frac{16}{3}$

(C) 16

(D) $\frac{64}{3}$

Question 44 (Level 5) — *Area with ex and tangent*
Find the area between $y = e^x$ and its tangent at $x = 0$ from $x = 0$ to $x = 1$.

(A) $e - \frac{5}{2}$

(B) $e - 2$

(C) $e - 1$

(D) $e - 3$

Question 45 (Level 5) — *Area between x and x*
Find the area enclosed between $y = \sqrt{x}$ and $y = x^2$.

(A) $\frac{1}{3}$

(B) $\frac{2}{3}$

(C) $\frac{1}{6}$

(D) $\frac{1}{2}$

Question 46 (Level 5) — *Area with trig identity*
Find the area under $y = \cos^2(x)$ from $x = 0$ to $x = \pi$.

(A) $\frac{\pi}{2}$

(B) π

(C) $\frac{\pi}{4}$

(D) 0

Question 47 (Level 5) — *Area ratio*
The line $y = kx$ divides the area under $y = x(1 - x)$ (for $0 \le x \le 1$) into two equal parts. Find k.

(A) $1 - \frac{1}{\sqrt[3]{2}}$

(B) $\frac{1}{2}$

(C) $1 - \frac{1}{\sqrt{2}}$

(D) $\frac{1}{3}$

Question 48 (Level 5) — *Area between ex and e2x*
Find the area between $y = e^x$ and $y = e^{2x}$ from $x = 0$ to $x = \ln 2$.

(A) $\frac{1}{2}$

(B) $\ln 2$

(C) 1

(D) $2 - \ln 2$

Question 49 (Level 5) — *Area enclosed by x = y*
Find the area enclosed between $x = y^2$ and $x = 2 - y^2$.

(A) $\frac{8}{3}$

(B) $\frac{4}{3}$

(C) 4

(D) $\frac{16}{3}$

Question 50 (Level 5) — *Area under $y = xe$-x*
Find $\int_0^2 x^2 e^{-x}\,dx$ (area under $y = x^2e^{-x}$ from 0 to 2).

(A) $2 - 10e^{-2}$

(B) $2 - 6e^{-2}$

(C) $10e^{-2}$

(D) $2 - 2e^{-2}$

Solutions

Q1: (A)
Area $= 5 \times 2 = 10$.
Q2: (A)
Area $= \frac{1}{2}(4)(4) = 8$.
Q3: (A)
$\left[\frac{x^3}{3}\right]_0^2 = \frac{8}{3}$.
Q4: (A)
$\int_a^b f(x)\,dx$.
Q5: (A)
$\left[\frac{3x^2}{2}\right]_0^2 = 6$.
Q6: (A)
$\left[\frac{x^2}{2} + x\right]_0^3 = \frac{9}{2} + 3 = \frac{15}{2}$.
Q7: (A)
$\frac{1}{3}$.
Q8: (A)
Area $= 5 \times 4 = 20$.
Q9: (A)
$[x^2]_1^3 = 9 - 1 = 8$.
Q10: (A)
$\frac{16}{4} = 4$.
Q11: (A)
$\left[\frac{x^3}{3}\right]_0^3 = 9$.
Q12: (A)
$\left[4x - \frac{x^2}{2}\right]_0^4 = 16 - 8 = 8$.
Q13: (A)
$\left[\frac{x^2}{2}\right]_0^3 = \frac{9}{2}$.
Q14: (A)
$-\left[\frac{x^3}{3} - 4x\right]_{-2}^2 = -\left[(\frac{8}{3} - 8) - (-\frac{8}{3} + 8)\right] = -\left[-\frac{16}{3} - \frac{16}{3}\right] = \frac{32}{3}$.
Q15: (A)
$\left[\frac{x^2}{2} - \frac{x^3}{3}\right]_0^1 = \frac{1}{2} - \frac{1}{3} = \frac{1}{6}$.
Q16: (A)
$x(x-1) = 0$, so $x = 0$ and $x = 1$.
Q17: (A)
$\int_{-2}^0 |x|\,dx + \int_0^3 x\,dx = 2 + \frac{9}{2} = \frac{13}{2}$.
Q18: (A)
$\left[\frac{x^3}{3} + x\right]_0^2 = \frac{8}{3} + 2 = \frac{14}{3}$.
Q19: (A)
$\left[4x - \frac{x^3}{3}\right]_{-2}^2 = (8 - \frac{8}{3}) - (-8 + \frac{8}{3}) = \frac{32}{3}$.
Q20: (A)
$\frac{2(27)}{3} = 18$.
Q21: (A)
$2x(x-1) = 0$: $x = 0, 1$. Area $= \int_0^1 (2x - 2x^2)\,dx = [x^2 - \frac{2x^3}{3}]_0^1 = 1 - \frac{2}{3} = \frac{1}{3}$.
Q22: (A)
$\int_{-\sqrt{2}}^{\sqrt{2}} (4 - 2x^2)\,dx = 2\int_0^{\sqrt{2}} (4 - 2x^2)\,dx = 2[4x - \frac{2x^3}{3}]_0^{\sqrt{2}} = 2(4\sqrt{2} - \frac{4\sqrt{2}}{3}) = \frac{16\sqrt{2}}{3}$.

Q23: (A)
$[e^x]_0^2 = e^2 - 1$.
Q24: (A)
By symmetry: $2\int_0^1 |x^3 - x|\,dx = 2\int_0^1 (x - x^3)\,dx = 2[\frac{x^2}{2} - \frac{x^4}{4}]_0^1 = 2 \cdot \frac{1}{4} = \frac{1}{2}$.
Q25: (A)
$\int_{-1}^2 (x + 2 - x^2)\,dx = [\frac{x^2}{2} + 2x - \frac{x^3}{3}]_{-1}^2 = (2 + 4 - \frac{8}{3}) - (\frac{1}{2} - 2 + \frac{1}{3}) = \frac{9}{2}$.
Q26: (A)
Area $= |-2| = 2$.
Q27: (A)
$[-\cos(x)]_0^\pi = 1 + 1 = 2$.
Q28: (A)
$\int_0^2 (4 - x^2)\,dx = [4x - \frac{x^3}{3}]_0^2 = 8 - \frac{8}{3} = \frac{16}{3}$.
Q29: (A)
$\int_0^2 (2x - x^2)\,dx = [x^2 - \frac{x^3}{3}]_0^2 = 4 - \frac{8}{3} = \frac{4}{3}$.
Q30: (A)
$[\ln(x)]_1^{e^2} = 2 - 0 = 2$.
Q31: (A)
$[e^x - x]_0^1 = (e - 1) - (1 - 0) = e - 2$.
Q32: (A)
$\int_0^{\pi/4} (\cos x - \sin x)\,dx = [\sin x + \cos x]_0^{\pi/4} = \sqrt{2} - 1$.
Q33: (A)
$\int_0^1 (e^x - e^{-x})\,dx = [e^x + e^{-x}]_0^1 = (e + e^{-1}) - 2 = e + \frac{1}{e} - 2$.
Q34: (A)
$\int_0^1 (1 - x^2)\,dx + \int_1^2 (x^2 - 1)\,dx = \frac{2}{3} + \frac{4}{3} = 2$.
Q35: (A)
$\int_0^1 (x - x^3)\,dx = [\frac{x^2}{2} - \frac{x^4}{4}]_0^1 = \frac{1}{4}$.
Q36: (A)
$e^k - 1 = e^2 - 1 \Rightarrow k = 2$.
Q37: (A)
$[-e^{-x}(x + 1)]_0^1 = -2e^{-1} + 1 = 1 - \frac{2}{e}$.
Q38: (A)
By symmetry: $2\int_0^1 (x - x^3)\,dx = 2 \cdot \frac{1}{4} = \frac{1}{2}$.
Q39: (A)
$\int_0^\pi \sin(x)\,dx + \int_\pi^{2\pi} |\sin(x)|\,dx = 2 + 2 = 4$.
Q40: (A)
$2x(x - 3) = 0$: $x = 0, 3$. $\int_0^3 (-2x^2 + 6x)\,dx = [-\frac{2x^3}{3} + 3x^2]_0^3 = -18 + 27 = 9$.
Q41: (A)
$\int_0^{\pi/4} (\cos x - \sin x)\,dx + \int_{\pi/4}^{\pi/2} (\sin x - \cos x)\,dx = (\sqrt{2} - 1) + (\sqrt{2} - 1) = 2\sqrt{2} - 2$.
Q42: (A)
$[x\ln(x) - x]_1^e = (e - e) - (0 - 1) = 1$.
Q43: (A)
$\int_{-2}^2 (4 - x^2)\,dx = [4x - \frac{x^3}{3}]_{-2}^2 = \frac{32}{3}$. And $\frac{4 \cdot 4 \cdot 2}{3} = \frac{32}{3}$. ✓
Q44: (A)
$\int_0^1 (e^x - x - 1)\,dx = [e^x - \frac{x^2}{2} - x]_0^1 = (e - \frac{1}{2} - 1) - 1 = e - \frac{5}{2}$.
Q45: (A)
$\int_0^1 (x^{1/2} - x^2)\,dx = [\frac{2x^{3/2}}{3} - \frac{x^3}{3}]_0^1 = \frac{2}{3} - \frac{1}{3} = \frac{1}{3}$.
Q46: (A)
$\int_0^\pi \frac{1 + \cos(2x)}{2}\,dx = [\frac{x}{2} + \frac{\sin(2x)}{4}]_0^\pi = \frac{\pi}{2}$.
Q47: (A)
$\int_0^{1-k} (x - x^2 - kx)\,dx = \frac{1}{12}$. $\int_0^{1-k} x(1 - k - x)\,dx = \frac{(1-k)^3}{6} = \frac{1}{12}$. $(1 - k)^3 = \frac{1}{2}$. $k = 1 - \frac{1}{\sqrt[3]{2}}$.

Q48: (A)
$\int_0^{\ln 2}(e^{2x}-e^x)\,dx = [\frac{e^{2x}}{2}-e^x]_0^{\ln 2} = (2-2)-(\frac{1}{2}-1) = \frac{1}{2}$.
Q49: (A)
$\int_{-1}^{1}(2-2y^2)\,dy = [2y-\frac{2y^3}{3}]_{-1}^{1} = 2(2-\frac{2}{3}) = \frac{8}{3}$.
Q50: (A)
$[-e^{-x}(x^2+2x+2)]_0^2 = -e^{-2}(10)+2 = 2-10e^{-2}$.