1. $\sqrt{8} + \sqrt{32} - \sqrt{162}$ can be simplified as

(A) $-3\sqrt{2}$

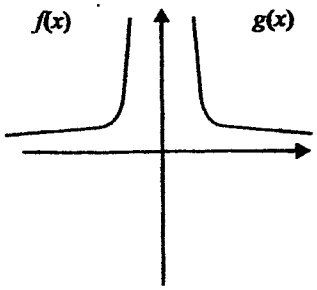
(B) $-2\sqrt{2}$

(C) $-4\sqrt{2}$

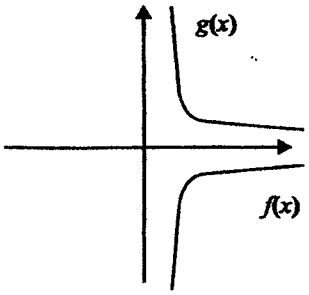
(D) $-6\sqrt{2}$

2. If $g(x)$ is the inverse function of $f(x)$ then the correct diagram is

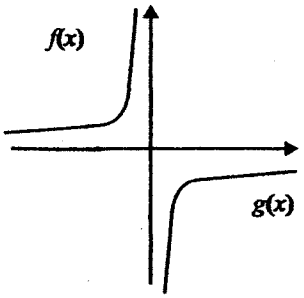
(A)



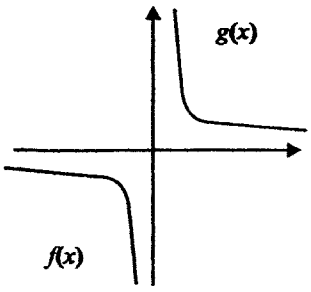
(B)



(C)



(D)



3. $\dfrac{\sqrt{x}-\sqrt{y}}{\sqrt{x}+\sqrt{y}}$ may be expressed as

(A) $\dfrac{x+y}{x-y}$

(B) $\dfrac{x-y}{x+y}$

(C) $\dfrac{x+y-2\sqrt{xy}}{x-y}$

(D) $\dfrac{x-y+2\sqrt{xy}}{x+y}$

4. If a remainder of 7 is obtained when $x^3 - 3x + k$ is divided by $x - 3$, then k equals

(A) -11
(B) -1
(C) 1
(D) 11

5. $(\sim \mathbf{p}) \wedge (\sim \mathbf{q}) \equiv$

(A) $\sim \mathbf{p} \wedge \sim \mathbf{q}$
(B) $\sim \mathbf{p} \vee \sim \mathbf{q}$
(C) $\sim (\mathbf{p} \vee \sim \mathbf{q})$
(D) $\sim (\mathbf{p} \wedge \mathbf{q})$

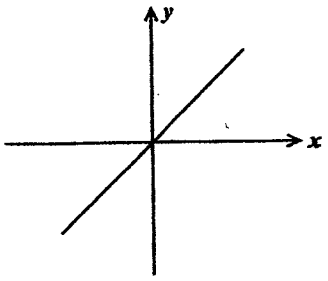
6. Given that x and y are negative integers, and that $x > y$, which of the following is true?

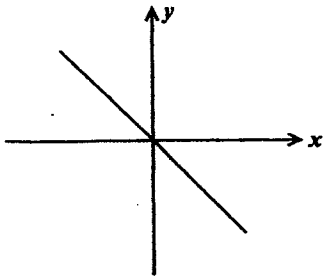
(A) $x^2 > y^2$
(B) $x^2 < y$
(C) $x > y^2$
(D) $x^2 < y^2$

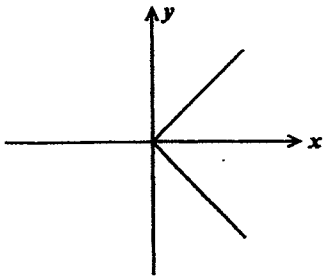
7. The range of values of x that satisfy the inequality $|x - b| < a$ is

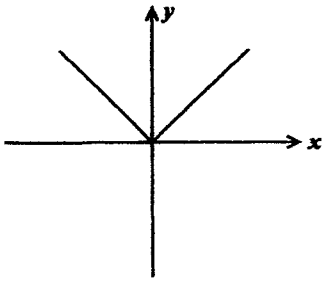
(A) $-a + b < x < a + b$
(B) $-a - b < x < a - b$
(C) $a - b < x < a + b$
(D) $a + b < x < a - b$

8. Which of the following mapping diagrams does NOT represent a function?

(A)


(B)


(C)


(D)


9. If $\log_a 4 + \log_a x - \log_a 7 = 2$, then the value of x is

(A) $\frac{7}{2^a}$

(B) $\frac{7}{4}a^2$

(C) $\frac{4}{7}a^2$

(D) $\frac{7}{4}2^a$

10. The value of $\log_{\sqrt{6}} 36$ is

(A) $\frac{1}{2}$
(B) 2
(C) 4
(D) 8

11. Which of the following sets of ordered pairs represent functions?

I. $\{(-1, 1), (0, 2), (1, 3), (4, 6)\}$
II. $\{(-2, 4), (1, 1), (1, 4), (2, 4)\}$
III. $\{(-1, 1), (0, 0), (1, 1), (-3, 9)\}$
IV. $\{(-2, 5), (-1, 5), (0, 5), (1, 5)\}$

(A) I and II only
(B) II and III only
(C) I, II and III only
(D) I, III and IV only

12. $\log 15 - \log 6 + \frac{1}{2}\log\frac{4}{25} =$

(A) 0
(B) 1
(C) $\frac{1}{2}\log\frac{36}{25}$
(D) $\log\frac{25}{4}$

13. Which of the following are factors of $4x^4 + 8x^3 - 2x^2 - 6x - 4$?

I. $x + 1$
II. $x - 1$
III. $x + 2$
IV. $x - 2$

(A) I and II only
(B) II and III only
(C) I and III only
(D) I and IV only

GO ON TO THE NEXT PAGE

14. The general cubic equation with roots α, β and γ may be written as

(A) $x^3-(\alpha+\beta+\gamma)x^2-(\alpha\beta+a\gamma+\beta\gamma)x-\alpha\beta\gamma=0$

(B) $x^3-(\alpha+\beta+\gamma)x^2+(\alpha\beta+a\gamma+\beta\gamma)x-\alpha\beta\gamma=0$

(C) $x^3-(\alpha+\beta+\gamma)x^2-(\alpha\beta+a\gamma+\beta\gamma)x+\alpha\beta\gamma=0$

(D) $x^3-(\alpha+\beta+\gamma)x^2+(\alpha\beta+a\gamma+\beta\gamma)x+\alpha\beta\gamma=0$

---

15. The tables below show the values for two functions, f and g.

x	0	1	2	3	4	5
f(x)	7	5	3	2	−7	−5

x	0	1	2	3	4	5
g(x)	3	$\frac{1}{4}$	$\frac{1}{2}$	5	$\frac{1}{3}$	2

The value of $g^{-1}[f(3)]$ is

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

(B) 2

(C) 5

(D) 7

16. A vector equation is given as $s\begin{pmatrix}-2\\1\end{pmatrix}+t\begin{pmatrix}1\\1\end{pmatrix}=\begin{pmatrix}-5\\1\end{pmatrix}$. The values of s and t are, respectively,

(A) −2 and −1

(B) −2 and 1

(C) 2 and 1

(D) 2 and −1

17. The value of $\cos\left(\frac{\pi}{2}-p\right)$ is

(A) $\cos p$

(B) $\sin p$

(C) $-\cos p$

(D) $-\sin p$

18. The line through the points $P(k, 2)$ and $Q(6, 8)$ is parallel to the line with equation $3x+y-21=0$. The value of k is

(A) 1

(B) 4

(C) 8

(D) 24

19. The expression $\sin 6\theta + \sin 4\theta$ may be expressed as

(A) $\sin 10\theta$

(B) $-2\cos 2\theta$

(C) $2\sin 5\theta\cos\theta$

(D) $2\cos 5\theta\sin\theta$

20. A curve is defined by the parametric equations $x=3+2t$ and $y=2+t$. The Cartesian equation of the curve is

(A) $x+y=1$

(B) $x+4y=7$

(C) $x+2y=1$

(D) $x-2y=-1$

21. What value of θ, $0\le\theta\le\pi$, satisfies the equation $2\cos^2\theta+3\cos\theta-2=0$?

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

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

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

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

GO ON TO THE NEXT PAGE

22. The expression $\cot x + \tan x$ can be written as

(A) $2 \operatorname{cosec} 2x$

(B) $2 \cot 2x$

(C) $\dfrac{\sin x + \cos y}{\sin x \cos x}$

(D) $\dfrac{\sin x - \cos x}{\sin x \cos x}$

23. The minimum and maximum values of $\dfrac{1}{2 + \sin\theta}$ are, respectively,

(A) -3 and -1

(B) -2 and 2

(C) $\dfrac{1}{3}$ and 1

(D) 1 and 3

24. With respect to an origin O, A has coordinates $(3, -2)$. The position vector of $3\overrightarrow{OA}$ is

(A) $(3, -6)$

(B) $(9, -2)$

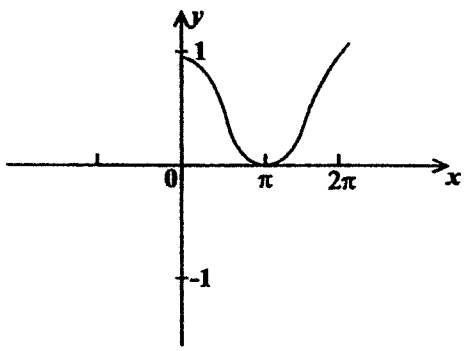
(C) $\begin{pmatrix} 9 \\ -2 \end{pmatrix}$

(D) $\begin{pmatrix} 9 \\ -6 \end{pmatrix}$

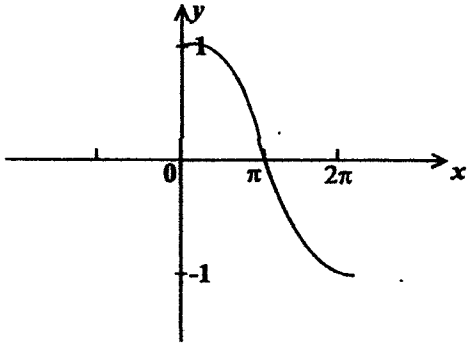
25. Which of the following sketches BEST represents the curve

$y = \cos\dfrac{x}{2}$, $(0 \le x \le 2\pi)$?

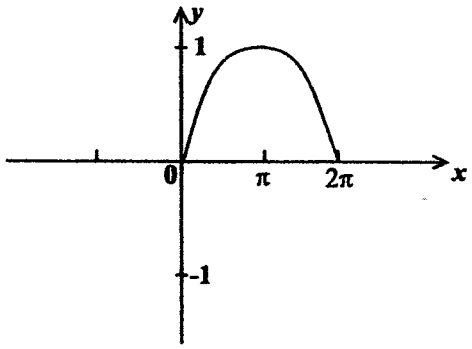
(A)



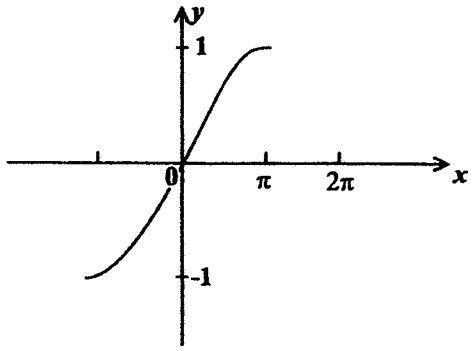
(B)



(C)



(D)



26. The variable point $P(x, y)$ moves so that it is the same distance from the points (1, 6) and (3, 2). The equation of the locus of P may be obtained from

(A) $\dfrac{y-6}{x-1} = \dfrac{y-2}{x-3}$

(B) $\dfrac{x-1}{y-6} = \dfrac{x-3}{y-2}$

(C) $\sqrt{(x-1)^2+(y-6)^2} = \sqrt{(x-3)^2+(y-2)^2}$

(D) $(x-1)+(y-6) = (x-3)+(y-2)$

---

27. The general solution for $\sin 2\theta = \sin\dfrac{\pi}{6}$ is

(A) $\theta = \begin{cases} 2n\pi + \dfrac{\pi}{6} \\ (2n+1)\dfrac{5\pi}{16} \end{cases}$

(B) $\theta = \begin{cases} n\pi + \dfrac{\pi}{12} \\ n\pi + \dfrac{5\pi}{12} \end{cases}$

(C) $\theta = \begin{cases} n\pi + \dfrac{\pi}{12} \\ (2n\pi)\dfrac{5\pi}{12} \end{cases}$

(D) $\theta = \begin{cases} n\pi + \dfrac{\pi}{6} \\ (n+1)\dfrac{5\pi}{6} \end{cases}$

28. A circle has centre (–1, –1). The equation of the tangent to the circle at the point (0, –3) on the circle is

(A) $y = -\dfrac{1}{2}x - 3$

(B) $y = \dfrac{1}{2}x - 3$

(C) $y = -2x - 3$

(D) $y = 2x - 3$

29. The cosine of the angle between the vectors $-6\,\mathbf{j}$ and $\mathbf{i} + \mathbf{j}$ is

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

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

(C) $\dfrac{-5}{\sqrt{2}}$

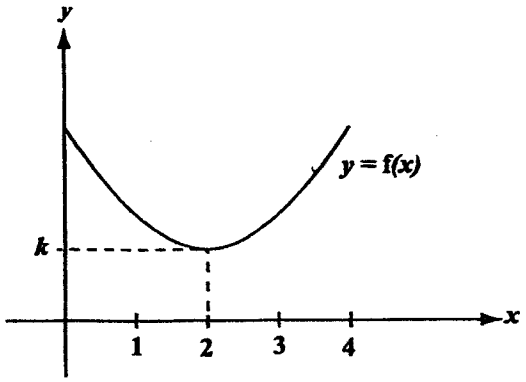
(D) $\dfrac{6}{\sqrt{2}}$

30. If $\mathbf{p} = 2\mathbf{i} + \mathbf{j}$ and $\mathbf{q} = \lambda\mathbf{i} + 6\mathbf{j}$ are perpendicular vectors, then the value of λ is

(A) –3
(B) –1
(C) 0
(D) 2

GO ON TO THE NEXT PAGE

Item 31 refers to the following diagram.

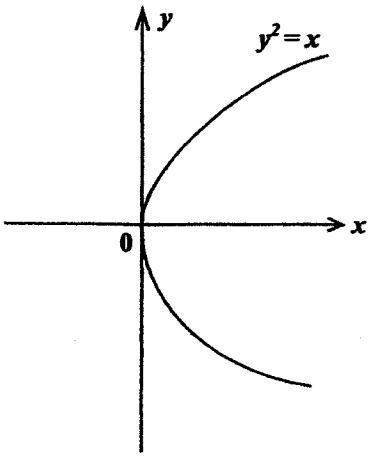


31. From the diagram above, which of the following statements are true?

I. $f'(1) < 0$
II. $f(1) > k$
III. $f(2) = 0$
IV. $f'(2) = k$

(A) I and II only
(B) I and III only
(C) II and III only
(D) II and IV only

Item 32 refers to the following diagram.



32. In the diagram above showing $y^2 = x$, y is NOT defined for

(A) $x = 0$
(B) $x \geq 0$
(C) $x > 0$
(D) $x < 0$

33. The function g is defined as

$$g(x) = \begin{cases} 3p + 2, & x < 3 \\ 3x - 1, & x \geq 3 \end{cases}$$

For the function to be continuous at $x = 3$, the value of p should be

(A) -4
(B) 1
(C) 2
(D) 6

34. A curve is given parametrically by the equations $x = t^2 - 2t$, $y = t^2 + 2t$. The **simplest** expression for $\frac{dy}{dx}$ is given by

(A) $\frac{t-1}{t+1}$

(B) $\frac{t+1}{t-1}$

(C) $\frac{2t-1}{2t+1}$

(D) $\frac{2t+1}{2t-1}$

35. Which of the following real functions has a point of discontinuity?

(A) $f(x) = \frac{4}{(x+1)^2}$

(B) $f(x) = \frac{x}{x^2+1}$

(C) $f(x) = 3 - x^2$

(D) $f(x) = \sqrt{x^2 + 9}$

36. A rod is heated and its length at time t seconds is given by $L = 5t^2 + 100$ centimetres. When $t = 3$, the rate of increase of L, in cm s^{-1}, is

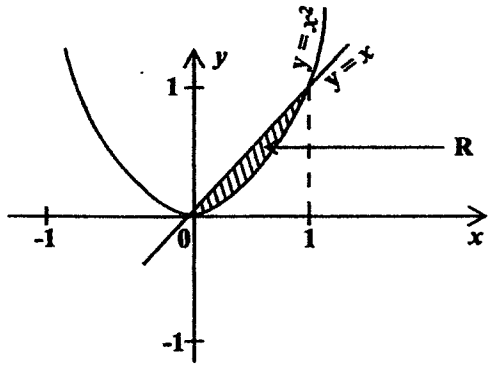
(A) 15
(B) 30
(C) 45
(D) 60

GO ON TO THE NEXT PAGE

37. $\lim_{x\to 3} \frac{x^2-9}{x-3}$ is

(A) $-\infty$
(B) 0
(C) 6
(D) ∞

Item 38 refers to the following diagram which shows the finite region R bounded by the line $y = x$ and the curve $y = x^2$.



38. The area of R is

(A) $\frac{1}{6}$
(B) $\frac{1}{3}$
(C) $\frac{1}{2}$
(D) $\frac{5}{6}$

39. The gradient at $x = \frac{\pi}{6}$ on the curve $y = \sin x$ is

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

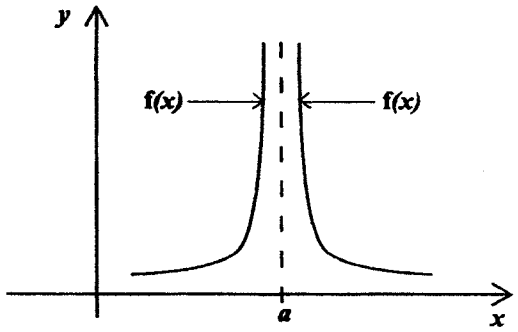
40. $\int_0^{\frac{\pi}{4}} \sec^2 x\, dx =$

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

41. Given that $\int_2^5 4f(x)dx = 9$, the value of $\int_2^5 3f(x)dx$ is

(A) $\frac{1}{4}$
(B) $\frac{3}{4}$
(C) $\frac{9}{4}$
(D) $\frac{27}{4}$

Item 42 refers to the following diagram.

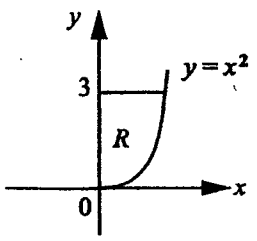


42. Based on the diagram above, which of the following statements is NOT correct?

(A) f(a) is undefined.
(B) $\lim_{x\to a} f(x) = f(a)$.
(C) $\lim_{x\to a} f(x)$ does not exist.
(D) f(x) is discontinuous at a.

GO ON TO THE NEXT PAGE

Item 43 refers to the following diagram.



43. The finite region R is enclosed by the curve $y = x^2$, the y-axis and the line $y = 3$ as shown in the diagram above. This region is rotated completely about the y-axis to form a solid of revolution. The volume of this solid is given by

(A) $\pi \int_0^3 x^4 dx$

(B) $\pi \int_0^9 x^4 dx$

(C) $\pi \int_0^3 y^2 dy$

(D) $\pi \int_0^3 y\, dy$

44. If $f''(x) = 6x$, then given that $f'(0) = 0$, and c is a constant, $f(x) =$

(A) $3x^2 + x + c$
(B) $x^3 + x + c$
(C) $3x^2 + c$
(D) $x^3 + c$

45. $\frac{d}{dx}(x^3 \sin x)$ may be expressed as

(A) $x^2 (\cos x + 3 \sin x)$
(B) $x^2 (x \cos x - 3 \sin x)$
(C) $x^2 (3 \cos x + \sin x)$
(D) $x^2 (x \cos x + 3 \sin x)$

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.