1. The expression $x - 3$ is a factor of

(A) $3x^4 - x^2 - 42$
(B) $2x^3 + 6x^2 + x + 3$
(C) $x^3 - 3x^2 - 5x + 15$
(D) $3x^4 - 8x^3 - 3x^2 + 1$

2. $\frac{1}{x+3} + \frac{3}{x^2-9}$ expressed as a single fraction is

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

(B) $\frac{x}{x^2-9}$

(C) $\frac{x+6}{x^2-9}$

(D) $\frac{x^2-6}{(x^2-9)(x+3)}$

3. The minimum value of the expression $4x^2 - 8x - 5$ is

(A) -9
(B) -5
(C) 1
(D) 8

4. If $x^2 - 6x + 13 = a(x + h)^2 + k$, then

(A) $a = 1 \quad h = -3 \quad k = 4$
(B) $a = 1 \quad h = 3 \quad k = 4$
(C) $a = 1 \quad h = -4 \quad k = 3$
(D) $a = -1 \quad h = 4 \quad k = 3$

5. The roots of the equation $3x^2 - 7x + 3 = 0$ are

(A) rational
(B) real and equal
(C) real and distinct
(D) not real and equal

6. What values of y simultaneously satisfy the equations $y = x^2 - 3x + 4$ and $y - x = 1$?

(A) 1 and 3
(B) 1 and 4
(C) 2 and 3
(D) 2 and 4

7. The values of x for which $\frac{3x-2}{2x+1} \leq 0$ are

(A) $x \leq \frac{2}{3}$

(B) $x > -\frac{1}{2}$

(C) $-\frac{1}{2} < x \leq \frac{2}{3}$

(D) $x \leq -\frac{1}{2}$ or $x \geq \frac{2}{3}$

8. The set of values of x for which $3x^2 + 5x > 2$ is

(A) $x > -1$

(B) $x > -\frac{1}{3}$

(C) $-\frac{3}{5} < x < 0$

(D) $x < -2$ or $x > \frac{1}{3}$

9. $\frac{4}{\sqrt{6}-2} =$

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

(B) $2(\sqrt{6}+2)$

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

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

10. $\sqrt[n]{3 \times 27^m}$ is equal to

(A) $3^{\frac{4m}{n}}$

(B) 3^{n+3m}

(C) $\sqrt[n]{81^{3m}}$

(D) $3^{\frac{3m+1}{n}}$

11. Given that $\log_p X = 6$ and $\log_p Y = 4$, the value of $\log_p \left(\frac{X}{Y}\right)$ is

(A) 2

(B) 10

(C) $\log_p 2$

(D) $\frac{\log_p 6}{\log_p 4}$

12. The value of x for which $3^{x+2} + 3^x = 90$ is

(A) $\frac{1}{2}\left(\frac{\log 90}{\log 3} - 2\right)$

(B) 2

(C) 44

(D) $\left(\frac{\log 10}{\log 3}\right)$

13. Which of the following is NOT an arithmetic sequence?

(A) 11, 2, –8, –19, ...
(B) 8, 12, 16, 20, ...
(C) 51, 45, 39, 33, ...
(D) –7, –9, –11, –13, ...

14. The sum of the first n terms of a geometric series is $S_n = 4^n - 1$. For this series,

I. the common ratio is –1

II. the first 3 terms are 3, 12 and 48

III. $S_{2n} = 2^{4n} - 1$

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

15. The expression $\sum_{r=1}^{5} (-1)^r (3)^{r+1} =$

(A) 1089
(B) 729
(C) –183
(D) –549

16. The line through the points Q(h, 2) and R(4, 8) is parallel to the line with equation $2x + y - 10 = 0$. The value of h is

(A) -7
(B) 2
(C) 1
(D) 7

17. The coordinates of the centre of a circle with equation $(x-1)^2 + (y+3)^2 = 36$ are

(A) $(-1, 3)$
(B) $(-3, 1)$
(C) $(1, -3)$
(D) $(3, -1)$

18. The line $x + y = 1$ and the circle $x^2 + y^2 = 5$ intersect at the points

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

19. The triangle OAB has vertices given by $\begin{pmatrix}0\\0\end{pmatrix}$, $\begin{pmatrix}a\\0\end{pmatrix}$ and $\begin{pmatrix}0\\-4\end{pmatrix}$ respectively. Given that the angle AÔB is $\frac{\pi}{2}$, then $a =$

(A) 2
(B) 3
(C) 4
(D) 6

Error. All options are correct

20. The vector **a** is given as $5\mathbf{i} + 12\mathbf{j}$. A unit vector parallel to **a** is

(A) $15\mathbf{i} + 36\mathbf{j}$
(B) $195\mathbf{i} + 468\mathbf{j}$
(C) $\frac{1}{13}(5\mathbf{i} + 12\mathbf{j})$
(D) $\frac{3}{13}(5\mathbf{i} + 12\mathbf{j})$

21. The position vector of the point P relative to an origin O is given as $\mathbf{p} = 5\mathbf{i} + 2\mathbf{j}$ and the position vector of Q relative to an origin O is given as $\mathbf{q} = -4\mathbf{i} + 10\mathbf{j}$.

Which of the following statements is true?

(A) **p** and **q** are parallel.
(B) **p** and **q** are perpendicular.
(C) The acute angle between **p** and **q** is 60°.
(D) The acute angle between **p** and **q** is 45°.

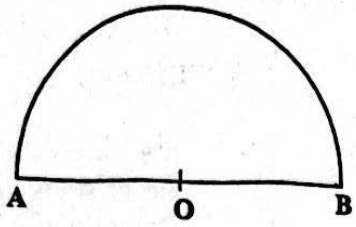
22. If $\cos 2x = 1 - 2s^2$, then $\sin x =$

(A) s
(B) s^2
(C) $2s$
(D) $1 - s^2$

23. The EXACT value of $\cos \frac{5\pi}{12} =$

(A) $\frac{1}{4}\left(\sqrt{6} - \sqrt{2}\right)$
(B) $\frac{1}{4}\left(\sqrt{6} + \sqrt{2}\right)$
(C) $\frac{1}{2}\left(\sqrt{6} + \sqrt{2}\right)$
(D) $\frac{1}{2}\left(\sqrt{6} - \sqrt{2}\right)$

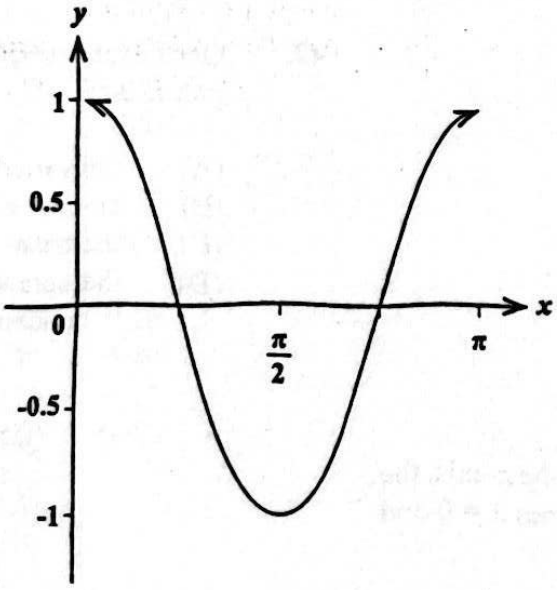
Item 24 refers to the following diagram.



24. If the area of the semicircle is 32π, what is the length of the arc connecting points A and B?

(A) 4π
(B) 8π
(C) 16π
(D) 32π

Item 25 refers to the following graph.



25. The graph shown above represents the function

(A) $\cos x$
(B) $\cos 2x$
(C) $\frac{1}{2}\cos x$
(D) $\cos\left(\frac{1}{2}x\right)$

26. The trigonometrical expression

$\frac{\sin x}{1-\cos x} + \frac{\sin x}{1+\cos x}$ is identical to

(A) $2 \sin x$
(B) $2 \tan x$
(C) $\tan^2 x$
(D) $\frac{2}{\sin x}$

27. If $\sin (90° - x) = \cos x$, then the value of x is

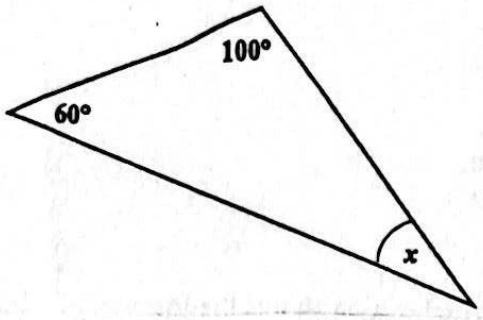
(A) 35°
(B) 45°
(C) 60°
(D) 70°

Error. All options are correct

28. $\sin 50° \cos 40° - \cos 50° \sin 40° =$

(A) $\sin 10°$
(B) $\cos 10°$
(C) $\sin 90°$
(D) $\cos 90°$

Item 29 refers to the following figure.



29. The size of angle x, measured in radians, is

(A) $\frac{\pi}{12}$

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

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

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

30. $\sin\left(\frac{\pi}{2}-x\right)+\cos\left(x+\frac{\pi}{2}\right)=$

(A) $\tan \pi$
(B) $\sin x - \cos x$
(C) $\cos x - \sin x$
(D) $1 - \sin x - \cos x$

31. Given that $y=\sqrt{5-x}$, then $\frac{dy}{dx}$ is

(A) $-\frac{1}{\sqrt{5-x}}$

(B) $\frac{1}{\sqrt{5-x}}$

(C) $\frac{1}{2\sqrt{5-x}}$

(D) $-\frac{1}{2\sqrt{5-x}}$

32. At the 10 m stopping point on a runway, an airplane is stationary before takeoff. If the airplane travels 120 m from this point in 4 seconds, what is its speed at the point of takeoff?

(A) 32 m/s
(B) 27 m/s
(C) 30 m/s
(D) 50 m/s

33. The gradient function $\frac{dy}{dx}$ of the curve $y = \sin(2x^2 + 1)$ is

(A) $4x \cos(2x^2 + 1)$

(B) $\cos(2x^2 + 1)$

(C) $\frac{1}{4x}\cos(2x^2 + 1)$

(D) $-4x \cos(2x^2 + 1)$

34. The point $P(1,1)$ lies on the curve $y=\frac{3x-2}{2x-1}$. The gradient of the tangent at point P is

(A) 1

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

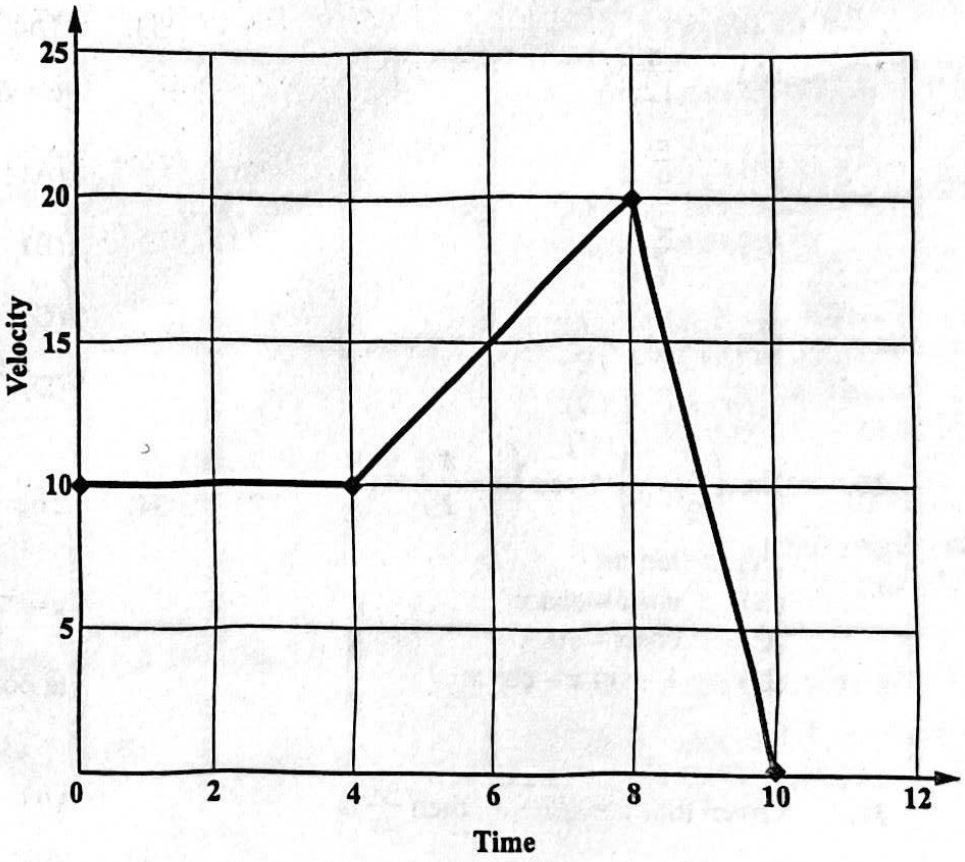
(C) 5

(D) -1

35. The curve C has the equation $y = f(x)$. C has a stationary point at $(-1, 2)$. If $f''(x) = \frac{6}{x^4} + 2$, then $(-1, 2)$ is

(A) an optimum point
(B) a point of inflexion
(C) a minimum turning point
(D) a maximum turning point

Item 36 refers to the following graph which shows the journey of a boy, where time is given in seconds and velocity in ms^{-1}.



36. During the journey there is a stage when the boy accelerates. The value of the acceleration is

(A) $-10.0\ ms^{-2}$
(B) $2.5\ ms^{-2}$
(C) $3.5\ ms^{-2}$
(D) $20.0\ ms^{-2}$

37. If c is a constant, then $\int (2x-5)^3\,dx =$

(A) $\frac{(2x-5)^4}{4} + c$

(B) $\frac{(2x-5)^2}{8} + c$

(C) $\frac{(2x-5)^4}{8} + c$

(D) $\frac{2(2x-5)}{4} + c$

38. If $\int_1^4 f(x)\,dx = 6$, then $\int_1^4 4f(x)\,dx + 5 =$

(A) 9
(B) 11
(C) 29
(D) 44

39. If c is a constant, then

$$\int (\sin x + 2\cos x)\,dx =$$

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

40. The region **R** is enclosed by the x-axis, the curve $y = -x^2 + 2$ and the lines $x = 0$ and $x = 1$. The area of **R** is

(A) 1

(B) $\frac{5}{3}$

(C) 2

(D) $\frac{7}{3}$

41. There are 108 cards in a deck of UNO playing cards. Of these, 4 are "Wild", 4 are "Wild Draw Four" and each of 4 colours (red, yellow, green, blue) is represented by 25 cards.

If a player needs to select 1 card, what is the probability of NOT drawing a "Wild Draw Four"?

(A) $\frac{26}{27}$

(B) $\frac{25}{108}$

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

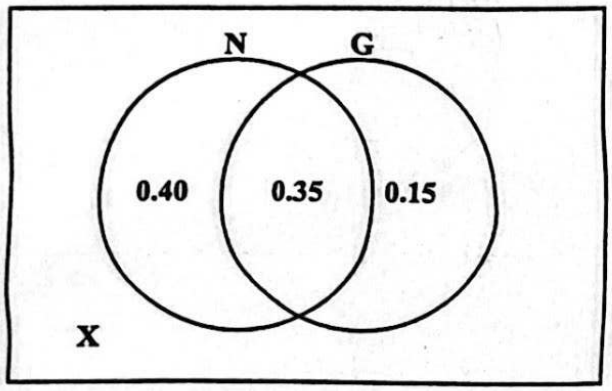
(D) $\frac{1}{108}$

42. One advantage of using a box and whisker plot is that

(A) the variance can be identified
(B) all data values can be identified
(C) the mean value can be identified
(D) the spread of the distribution can be identified

Items 43 and 44 refer to the following Venn diagram.

There are 120 students in a school's music club. The Venn diagram shows the probabilities that a randomly selected student plays the piano (N) or guitar (G).



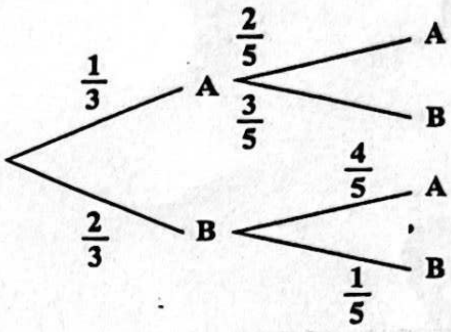
43. What is the value of X?

(A) 0.10
(B) 0.35
(C) 0.90
(D) 1.00

44. What is P(N | G)?

(A) 0.10
(B) 0.40
(C) 0.47
(D) 0.70

Item 45 refers to the following diagram.



45. The tree diagram above shows the probability of Events A and B occurring. Based on the diagram, the value of $P(A|B)$ =

(A) $\frac{1}{5}$

(B) $\frac{8}{15}$

(C) $\frac{3}{5}$

(D) $\frac{4}{5}$