LIST OF FORMULAE

Arithmetic Series $T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}[2a + (n-1)d]$

Geometric Series $T_n = ar^{n-1}$ $\quad S_n = \frac{a(r^n - 1)}{r - 1}$ $\quad S_\infty = \frac{a}{1-r}, \ -1 < r < 1$ or $|r| < 1$

Circle $x^2 + y^2 + 2fx + 2gy + c = 0$ $\quad (x+f)^2 + (y+g)^2 = r^2$

Vectors $\hat{\mathbf{v}} = \frac{\mathbf{v}}{|\mathbf{v}|}$ $\quad \cos\theta = \frac{\mathbf{a}\bullet\mathbf{b}}{|\mathbf{a}| \times |\mathbf{b}|}$ $\quad |\mathbf{v}| = \sqrt{(x^2 + y^2)}$ where $\mathbf{v} = x\mathbf{i} + y\mathbf{j}$

Trigonometry

$$\sin(A \pm B) \equiv \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) \equiv \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) \equiv \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

Differentiation

$$\frac{d}{dx}(ax+b)^n = an(ax+b)^{n-1}$$

$$\frac{d}{dx}\sin x = \cos x$$

$$\frac{d}{dx}\cos x = -\sin x$$

Statistics

$$\overline{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}, \quad S^2 = \frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n} = \frac{\sum_{i=1}^{n} f_i x_i^2}{\sum_{i=1}^{n} f_i} - (\overline{x})^2$$

Probability $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Kinematics $v = u + at$ $\quad v^2 = u^2 + 2as$ $\quad s = ut + \frac{1}{2}at^2$

1. The expression $x-2$ is a factor of

(A) $4x^4-2x^2-56$
(B) $4x^3+2x^2-16$
(C) $2x^3+2x^2-4x-8$
(D) $3x^4-10x^3-5x^2+4$

2. The expression $ab+3c-3b-ac$ is equal to

(A) $(a+3)\ (c-b)$
(B) $(a+3)\ (b-c)$
(C) $(a-3)\ (b+c)$
(D) $(a-3)\ (b-c)$

3. 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) $a=-1 \quad h=4 \quad k=3$

4. The roots of the equation $3x^2-6x-5=0$ are

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

5. The values of x for which $(x+15)^2=64x$ are

(A) 3 and 5
(B) 9 and 5
(C) 3 and 25
(D) 9 and 25

6. The range of values for which $x^2-7x+10<0$ is

(A) $2>x>5$
(B) $2<x<5$
(C) $x<2$ and $x>5$
(D) $x<-5$ and $x>-5$

7. The set of values of x for which $3x+2>x-2$ is

(A) $\{x : x>2\}$
(B) $\{x : x<-2\}$
(C) $\{x : x>0\}$
(D) $\{x : x>-2\}$

8. Functions f and g are defined by

$f: x \rightarrow 2x-5$ and $g: x \rightarrow 4+\dfrac{3}{x}, x \neq 0.$

The composite function gf is defined by

(A) $gf: x \rightarrow \dfrac{8x-17}{2x-5},\ x \neq \dfrac{5}{2}$
(B) $gf: x \rightarrow 3+\dfrac{6}{x},\ x \neq 0$
(C) $gf: x \rightarrow \dfrac{6}{x}-5,\ x \neq 0$
(D) $gf: x \rightarrow \dfrac{8x-20}{2x-5},\ x \neq \dfrac{5}{2}$

9. Given that $f(x)=x^2+4x-21$, the range of $f(x)$ is

(A) $f(x) \geq -21$
(B) $-7 \leq f(x) \leq 3$
(C) $f(x) \geq -25$
(D) $f(x) \leq -2$

10. If function $m: x \to 5 + 2x$, then $m(4 - 2a)$ is

(A) $4 - 4a$
(B) $9 - 2a$
(C) $8 - 4a$
(D) $13 - 4a$

11. If $f: x \to 2\left(\frac{x}{3} + 5\right)$, then $f^{-1}(x)$ is equal to

(A) $\frac{3(x-2)}{5}$

(B) $3\left(\frac{x}{2} - 5\right)$

(C) $3\left(\frac{x}{2} + 5\right)$

(D) $\frac{1}{3}\left(\frac{x}{2} - 5\right)$

12. Given that $3 \times 27^{2x} = 9^x$, the value of x is

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

(B) -1

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

(D) 1

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

(A) $\sqrt[\pi]{81^{3m}}$

(B) $3^{\pi + 3m}$

(C) $3^{\frac{3m+1}{\pi}}$

(D) $3^{\frac{4m}{\pi}}$

14. The value of x for which $4^{x+1} = 2$ is

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

(B) 0

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

(D) 1

15. Given that $\log_2 x^3 = 6$, then the value of x is

(A) 2
(B) 4
(C) 8
(D) 64

16. Given that α and β are the roots of the equation $x^2 + 3x + 4 = 0$, what is the value of $(\alpha + \beta)^2$?

(A) $\frac{9}{16}$

(B) 1

(C) 9

(D) 16

17. The common ratio of the geometric sequence 8, 12, 18, . . . is

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

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

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

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

18. The sum of the ODD integers between 10 and 50 is

(A) 60
(B) 600
(C) 630
(D) 1960

19. For the arithmetic progression $-12, -7, -2, 3, 8$ ... the n^{th} term is given by

(A) $5n - 17$
(B) $5n - 12$
(C) $-12 - 5n$
(D) $5n + 17$

20. The first four terms of a convergent geometric progression (GP) is given by $500, 200, 80, 32$. The sum to infinity of this GP is

(A) 200

(B) $\frac{500}{3}$

(C) 300

(D) $\frac{2500}{3}$

21. A line L passes through the point (6, 5) and is perpendicular to the line whose equation is $3x + 4y - 7 = 0$. The equation of L is

(A) $3x - 4y - 30 = 0$
(B) $3x + 4y - 11 = 0$
(C) $4x + 3y - 7 = 9$
(D) $4x - 3y - 9 = 0$

22. The line $y = 2x - 7$ and the line $x + 3y = 7$ intersect at the point

(A) (4, 1)
(B) (8, 6)
(C) (–5, 4)
(D) (0, –7)

23. A circle C has centre (3, –2) and radius 4. The equation of C is

(A) $x^2 + y^2 + 6x - 4y + 3 = 0$
(B) $x^2 + y^2 - 3 = 0$
(C) $x^2 + y^2 - 6x + 4y - 3 = 0$
(D) $x^2 + y^2 + 3x - 2y - 3 = 0$

24. Two vectors are equal if they

(A) have the same magnitude and different directions
(B) have the same magnitude and same direction
(C) are parallel and in different directions
(D) have different magnitudes and are in the same direction

25. 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) $\frac{3}{13}(5\mathbf{i} + 12\mathbf{j})$

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

27. The EXACT value of $\dfrac{\sin 150^\circ}{\cos 150^\circ}$ is given as

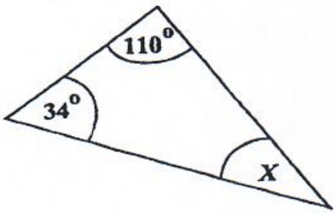
(A) $-\dfrac{1}{\sqrt{3}}$

(B) $\dfrac{1}{\sqrt{3}}$

(C) $-\sqrt{3}$

(D) $\sqrt{3}$

Item <u>28</u> refers to the following triangle.



28. The size of angle X, measured in radians, is

(A) $\dfrac{\pi}{5}$

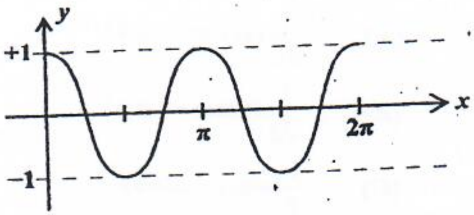
(B) $\dfrac{\pi}{10}$

(C) $\dfrac{\pi}{20}$

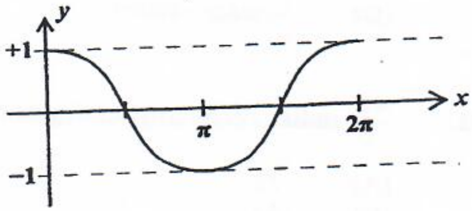
(D) $\dfrac{\pi}{25}$

29. Which of the following graphs represents $y = \sin x$?

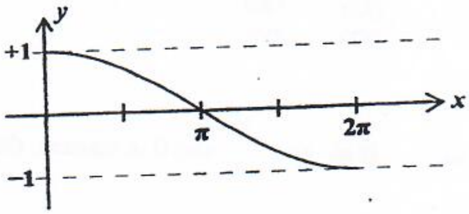
(A)



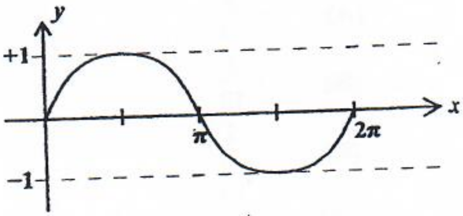
(B)



(C)



(D)



30. The **smallest** positive angle within the range $0 \leq \theta \leq 2\pi$ that satisfies the equation $(2\cos\theta - 1)(\cos\theta - 2) = 0$ is

(A) $\dfrac{\pi}{3}$

(B) $\dfrac{2\pi}{3}$

(C) $\dfrac{4\pi}{3}$

(D) $\dfrac{5\pi}{3}$

31. $\sin(\alpha - 45°)$ is equal to

(A) $\frac{1}{\sqrt{2}}(\sin\alpha - \cos\alpha)$

(B) $\frac{1}{\sqrt{2}}(\cos\alpha - \sin\alpha)$

(C) $\frac{1}{2}(\sin\alpha - \cos\alpha)$

(D) $\frac{1}{2}(\cos\alpha - \sin\alpha)$

32. $\frac{4\pi}{5}$ radians converted to degrees is

(A) 72
(B) 144
(C) 180
(D) 288

33. If $\sin\theta = \frac{5}{13}$ and θ is **obtuse**, then $\tan\theta =$

(A) $-\frac{12}{13}$

(B) $-\frac{5}{12}$

(C) $\frac{5}{12}$

(D) $\frac{12}{13}$

34. 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) $\frac{2}{\sin x}$

(D) $\tan^2 x$

35. $\frac{d}{dx}\sqrt{(7x^2+4)} =$

(A) $\frac{14x}{\sqrt{7x^2+4}}$

(B) $\frac{7x}{\sqrt{7x^2+4}}$

(C) $\frac{7x}{2\sqrt{7x^2+4}}$

(D) $\frac{7}{\sqrt{7x^2+4}}$

36. At the point (7, 4) on the curve $y = f(x)$ $\frac{dy}{dx} = 0$ and $\frac{d^2y}{dx^2} = -5$.

The point (7, 4) is

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

37. Given that $y = \cos 2x$, then $\frac{dy}{dx} =$

(A) $\sin 2x$

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

(C) $-2\sin 2x$

(D) $2\sin 2x$

38. If $y = \dfrac{x^2}{x+3}$ then $\dfrac{dy}{dx}$ is

(A) $\dfrac{-3x(x+2)}{(x+3)^2}$

(B) $\dfrac{3x(x+2)}{(x+3)^2}$

(C) $\dfrac{-x(x+6)}{(x+3)^2}$

(D) $\dfrac{x(x+6)}{(x+3)^2}$

39. The curve C with equation $y = f(x)$ has a stationary point at $(-2, 5)$.
If $f''(x) = x^4 - 15$, then $(-2, 5)$ is

(A) an intercept
(B) a vertex
(C) a minimum turning point
(D) a maximum turning point

40. If $\int_2^a (6+3x)\, dx = 72$, where $a > 2$, then $a =$

(A) 6
(B) 10
(C) 36
(D) 72

41. The region bounded by the curve $y = x^2$, the x–axis and the lines $x = 0$ and $x = 1$ is rotated 360° about the x- axis. The volume of the solid generated can be found from:

(A) $\pi\int_0^1 x^2 dx$

(B) $\int_0^1 x^4 dx$

(C) $\int_0^1 x^2 dx$

(D) $\pi\int_0^1 x^4 dx$

42. $\int (2x-5)^3\, dx =$

(A) $\dfrac{(2x-5)^4}{4} + C$

(B) $\dfrac{(2x-5)^2}{8} + C$

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

(D) $\dfrac{2(2x-5)}{4} + C$

43. If $y = 3x^2 + \cos x$ then $\int y\, dx =$

(A) $x^3 - \sin x + c$

(B) $x^3 + \sin x + c$

(C) $6x - \sin x + c$

(D) $3x^3 - \sin x + c$

44. $\int_1^2 (1 + x + x^2)\,dx =$

(A) 2

(B) 4

(C) $4\frac{5}{6}$

(D) $8\frac{1}{2}$

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

(A) 1

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

(C) 2

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

END OF TEST

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