FORMULAS FOR REFERENCE

SPHERE	Surface area	$= 4\pi r^2$
	Volume	$= \dfrac{4}{3}\pi r^3$
CYLINDER	Area of curved surface	$= 2\pi rh$
	Volume	$= \pi r^2 h$
CONE	Area of curved surface	$= \pi rl$
	Volume	$= \dfrac{1}{3}\pi r^2 h$
PRISM	Volume	$= \text{base area} \times \text{height}$
PYRAMID	Volume	$= \dfrac{1}{3} \times \text{base area} \times \text{height}$

There are 36 questions in Section A and 18 questions in Section B.
The diagrams in this paper are not necessarily drawn to scale.
Choose the best answer for each question.

Section A

1. If $f(x) = 2x^2 + kx - 1$ and $f(-2) = f\left(\dfrac{1}{2}\right)$, then $k =$

    A. $\dfrac{-17}{3}$.

    B. -5.

    C. 3.

    D. $\dfrac{31}{5}$.

2. Let $f(x) = x^3 + 2x^2 + k$, where k is a constant. If $f(-1) = 0$, find the remainder when $f(x)$ is divided by $x - 1$.

    A. -1

    B. 0

    C. 2

    D. 6

3. If $a = \dfrac{b-1}{b-2}$, then $b =$

   A. $\dfrac{2a-1}{a-1}$.

   B. $\dfrac{2a-1}{a+1}$.

   C. $\dfrac{1}{a-1}$.

   D. $\dfrac{1}{a+1}$.

4. $3^x \cdot 9^y =$

   A. 3^{x+2y} .

   B. 3^{x+3y} .

   C. 27^{x+y} .

   D. 27^{xy} .

5. If the equation $x^2 - 4x + k = 1$ has no real roots, then the range of values of k is

   A. $k > 4$.

   B. $k \geq 4$.

   C. $k > 5$.

   D. $k \geq 5$.

6. If $(2x+3)(x-a) \equiv 2x^2 + b(x+1)$, then

   A. $a = -3$ and $b = 9$.

   B. $a = \dfrac{-1}{3}$ and $b = \dfrac{11}{3}$.

   C. $a = \dfrac{1}{3}$ and $b = \dfrac{7}{3}$.

   D. $a = 3$ and $b = -9$.

7. If $\begin{cases} y = x^2 + 4 \\ y = -3x + 4 \end{cases}$, then $y =$

   A.   0.

   B.   13.

   C.   0 or -3.

   D.   4 or 13.

8. The solution of $x > 1$ and $13 < 3x - 2 < 25$ is

   A. $x > 1$.

   B. $1 < x < 5$.

   C. $1 < x < 9$.

   D. $5 < x < 9$.

9. If $0.8448 < a < 0.8452$, which of the following must be true?

   A. $a = 0.9$ (correct to 1 significant figure)

   B. $a = 0.85$ (correct to 2 significant figures)

   C. $a = 0.845$ (correct to 3 significant figures)

   D. $a = 0.8450$ (correct to 4 significant figures)

10. The sum of the 4th term and the 5th term of a geometric sequence is -4 . If the sum of the first two terms is 32 , find the first term of the sequence.

   A. -6

   B. $\dfrac{-1}{2}$

   C. 19

   D. 64

11. John's daily working hours have increased from 8 hours to 10 hours but his hourly pay has decreased by 25% . Find the percentage change in John's daily income.

   A.   A decrease of 6.67%

   B.   A decrease of 6.25%

   C. 0%

   D.   An increase of 6.67%

12. A sum of $\$8000$ is deposited at 1% p.a., compounded yearly. Find the interest earned after 4 years. Give the answer correct to the nearest dollar.

   A. $\$303$

   B. $\$320$

   C. $\$324$

   D. $\$325$

13. If $81^x = 27^{2y}$ and x , y are non-zero integers, then $x : y =$

   A. $2 : 3$.

   B. $3 : 4$.

   C. $4 : 3$.

   D. $3 : 2$.

14. Suppose z varies directly as x^2 and inversely as y . When $x = 4$ and $y = 3$, $z = 2$. When $x = 2$ and $z = 3$, $y =$

   A. $\dfrac{1}{2}$.

   B. 1 .

   C. 2 .

   D. 18 .

15. The scale of a map is $1:4\,000$. If the actual area of a sports field is $8\,000\text{ m}^2$, find its area on the map.
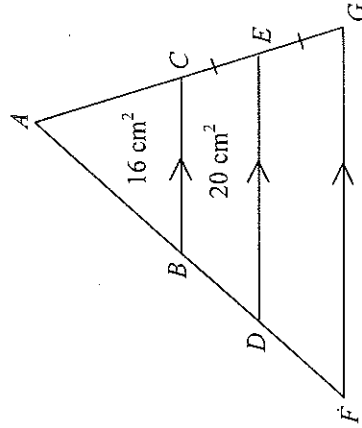
   A. 0.02 cm^2

   B. 0.05 cm^2

   C. 2 cm^2

   D. 5 cm^2

16. The length of a side of a regular 8-sided polygon is 6 cm. Find its area, correct to 3 significant figures.
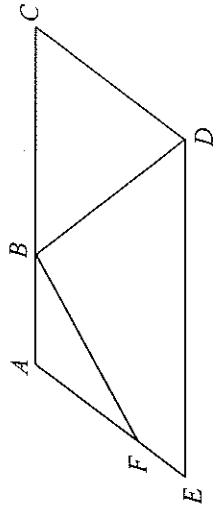
   A. 27.6 cm^2

   B. 29.8 cm^2

   C. 66.5 cm^2

   D. 174 cm^2

17. In the figure, $ABDF$ and $ACEG$ are straight lines. If the area of $\triangle ABC$ is 16 cm^2 and the area of quadrilateral $BDEC$ is 20 cm^2, then the area of quadrilateral $DFGE$ is

   A. 24 cm^2.

   B. 28 cm^2.

   C. 36 cm^2.

   D. 44 cm^2.

18. In the figure, $AEDC$ is a parallelogram. If $AB:BC=1:2$ and $AF:FE=2:1$, then area of $\triangle ABF$: area of $\triangle BCD =$
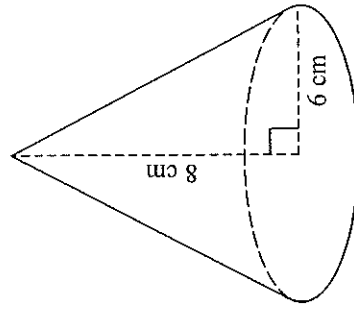

   A. $1:2$.

   B. $1:3$.

   C. $1:4$.

   D. $2:9$.

19. In the figure, OAB is a sector and $\overset{\frown}{AB} = \pi$ cm. Find the area of the sector.
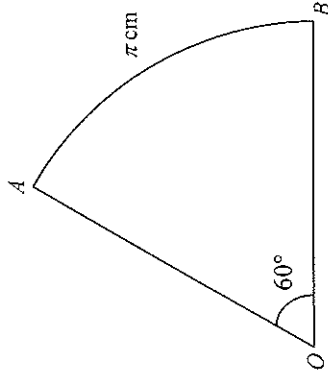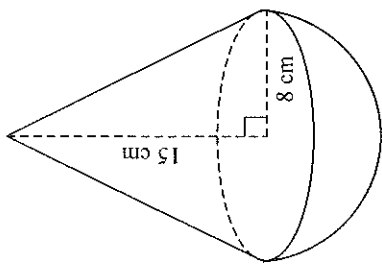

   A. $\dfrac{3}{2}\pi\text{ cm}^2$

   B. $3\pi\text{ cm}^2$

   C. $\dfrac{9}{2}\pi\text{ cm}^2$

   D. $6\pi\text{ cm}^2$

20. The figure shows a right circular cone of base radius 6 cm and height 8 cm. Find its volume.

   A. $32\pi\text{ cm}^3$

   B. $60\pi\text{ cm}^3$

   C. $96\pi\text{ cm}^3$

   D. $288\pi\text{ cm}^3$

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21. In the figure, the solid consists of a right circular cone and a hemisphere with a common base. Find the total surface area of the solid.

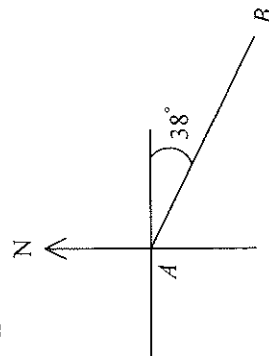A. 136π cm^2

B. 248π cm^2

C. 264π cm^2

D. 392π cm^2

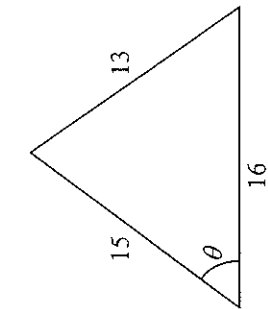22. If θ is an acute angle and $\sin\theta = \cos\theta$, then $\cos\theta =$

A. $\dfrac{1}{2}$.

B. $\dfrac{\sqrt{2}}{2}$.

C. $\dfrac{\sqrt{3}}{2}$.

D. 1.

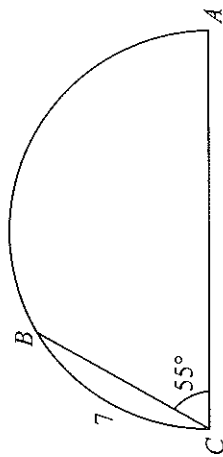23. In the figure, the bearing of A from B is

A. N 38° W.

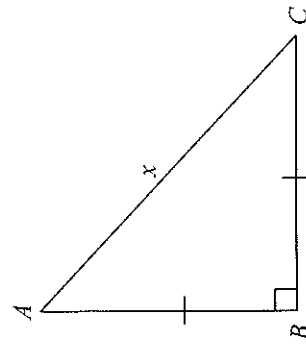B. N 52° W.

C. S 38° E.

D. S 52° E.

24. In the figure, $\cos\theta =$

A. $\dfrac{15}{16}$.

B. $\dfrac{13}{20}$.

C. $\dfrac{25}{52}$.

D. $\dfrac{23}{65}$.

25. In the figure, ABC is a semicircle with $\overset{\frown}{BC} = 7$ and $\angle ACB = 55°$. Find $\overset{\frown}{AB}$.
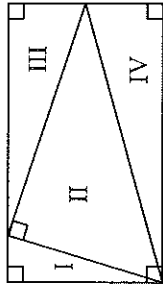

A. 9

B. 10

C. 11

D. 14

26. In the figure, $AB =$

A. $\dfrac{x}{2}$.

B. $\dfrac{\sqrt{2}}{2}x$.

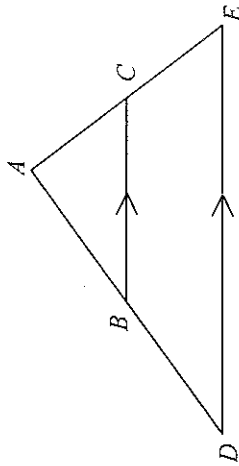C. $\dfrac{\sqrt{3}}{2}x$.

D. $\sqrt{2}x$.

27. Which of the following statements about the triangles in the figure must be true?

    A.   I and III are similar.

    B.   I and IV are similar.

    C.   II and III are similar.

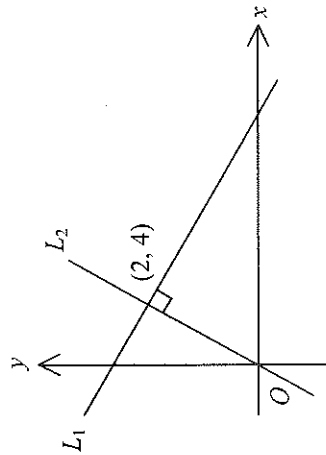   D.   II and IV are similar.

28. In the figure, ABD and ACE are straight lines. If $AC : CE = 3 : 4$, then $BC : DE =$

    A. $1 : 2$.

    B. $3 : 4$.

    C. $3 : 7$.

    D. $4 : 7$.

29. In the figure, the straight lines L_1 and L_2 intersect at $(2, 4)$. Find the equation of L_1.

    A. $x + 2y = 10$

    B. $x - 2y = -6$

    C. $2x + y = 8$

    D. $2x - y = 0$

30. If the straight line $2x + y + k = 0$ passes through the point of intersection of the two straight lines $x + y - 3 = 0$ and $x - y + 1 = 0$, find k.

    A. -4

    B. -2

    C. 2

    D. 4

31. $P(-10, -8)$ and $Q(4, 6)$ are two points. If R is a point on the x-axis such that $PR = RQ$, then the coordinates of R are

    A. $(-4, 0)$.

    B. $(-3, -1)$.

    C. $(-3, 0)$.

    D. $(-2, 0)$.

32. The mean mark of a mathematics test was 63 marks. Peter got 75 marks in the test and his standard score was 0.75. If Mary got 83 marks in the same test, then her standard score would be

    A.   0.83.

    B.   1.25.

    C.   2.22.

    D.   5.

33. The median of the five numbers 15, $x-1$, $x-3$, $x-4$ and $x+17$ is 8.
Find the mean of the five numbers.

A. 8

B. 12

C. 13.6

D. 14.4

34. A bag contains 2 black balls, 2 green balls and 2 yellow balls. Peter repeats drawing one ball at a time randomly from the bag without replacement until a green ball is drawn. Find the probability that he needs at most 4 draws.

A. $\dfrac{1}{15}$

B. $\dfrac{2}{15}$

C. $\dfrac{14}{15}$

D. $\dfrac{65}{81}$

35. $1232\bigstar$ is a 5-digit number, where $\bigstar$ is an integer from 0 to 9 inclusive. The probability that the 5-digit number is divisible by 4 is

A. $\dfrac{1}{3}$.

B. $\dfrac{1}{4}$.

C. $\dfrac{1}{5}$.

D. $\dfrac{3}{10}$.

36. x is the mean of the group of numbers $\{a, b, c, d, e\}$. Which of the following statements about the two groups of numbers $\{a, b, c, d, e\}$ and $\{a, b, c, d, e, x\}$ must be true?

I. The two groups of numbers have the same mean.
II. The two groups of numbers have the same range.
III. The two groups of numbers have the same standard deviation.

A. I only

B. III only

C. I and II only

D. II and III only

Section B

37. $\dfrac{10}{x^2+x-6}-\dfrac{2}{x-2}=$

    A. $\dfrac{2}{x+3}$.

    B. $\dfrac{-2}{x+3}$.

    C. $\dfrac{13-2x}{(x+3)(x-2)}$.

    D. $\dfrac{16-2x}{(x+3)(x-2)}$.

38. The L.C.M. of $210xy^2$ and $30x^2yz$ is

    A. $30xy$.

    B. $70xyz$.

    C. $210x^2y^2z$.

    D. $630x^3y^3z$.

39. $x^3-\dfrac{27}{x^3}=$

    A. $\left(x+\dfrac{3}{x}\right)\left(x^2-6+\dfrac{9}{x^2}\right)$.

    B. $\left(x+\dfrac{3}{x}\right)\left(x^2-3+\dfrac{9}{x^2}\right)$.

    C. $\left(x-\dfrac{3}{x}\right)\left(x^2+6+\dfrac{9}{x^2}\right)$.

    D. $\left(x-\dfrac{3}{x}\right)\left(x^2+3+\dfrac{9}{x^2}\right)$.

40. If $10^{a+b}=c$, then $b=$

    A. $\log c-a$.

    B. $a-\log c$.

    C. $\dfrac{c}{10}-a$.

    D. $c-10^a$.

41. Let k be a constant. If α and β are the roots of the equation $x^2-3x+k=0$, then $\alpha^2+3\beta=$

    A. $3-k$.

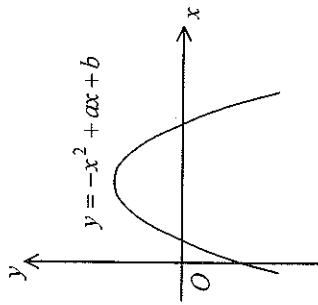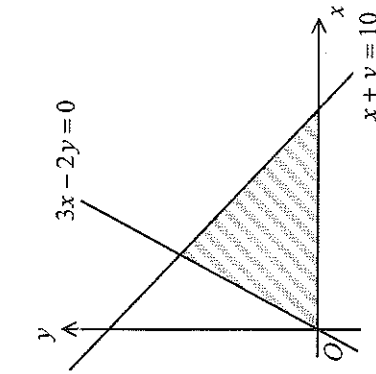   B. $3+k$.

    C. $9-k$.

    D. $9+k$.

42. The figure shows the graph of $y = -x^2 + ax + b$. Which of the following is true?

$$y = -x^2 + ax + b$$

A. $a < 0$ and $b < 0$

B. $a < 0$ and $b > 0$

C. $a > 0$ and $b < 0$

D. $a > 0$ and $b > 0$

43. Which of the following systems of inequalities has its solution represented by the shaded region in the figure?

A. $\begin{cases} 3x - 2y \le 0 \\ x + y \ge 10 \\ x \ge 0 \end{cases}$

B. $\begin{cases} 3x - 2y \ge 0 \\ x + y \le 10 \\ x \ge 0 \end{cases}$

C. $\begin{cases} 3x - 2y \le 0 \\ x + y \ge 10 \\ y \ge 0 \end{cases}$

D. $\begin{cases} 3x - 2y \ge 0 \\ x + y \le 10 \\ y \ge 0 \end{cases}$

44. In the figure, $ABCD$ and $PQRS$ are two rectangles of equal perimeter. If $AB : BC = 3 : 2$ and $PQ : QR = 4 : 3$, then area of $ABCD$: area of $PQRS$ =
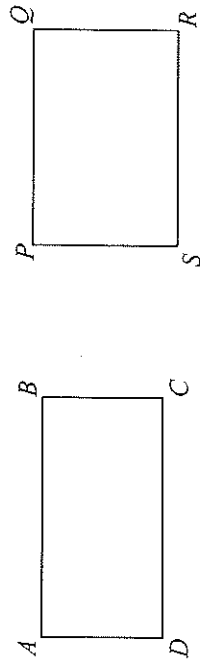
A. $1 : 1$.

B. $1 : 2$.

C. $25 : 49$.

D. $49 : 50$.

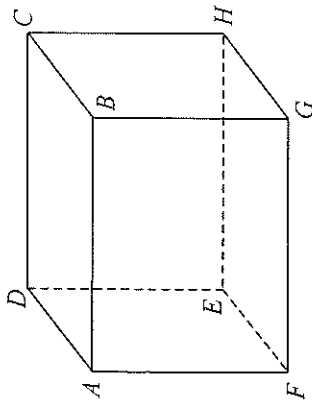45. For $0° \le \theta < 360°$, how many roots does the equation $2\cos^2 \theta - 5\sin \theta - 4 = 0$ have?

A. 1

B. 2

C. 3

D. 4

46. $\dfrac{\tan(180° - \theta)}{\cos(90° - \theta)} =$

   A. $\dfrac{1}{\cos\theta}$.

   B. $\dfrac{-1}{\cos\theta}$.

   C. $\dfrac{\sin\theta}{\cos^2\theta}$.

   D. $\dfrac{-\sin\theta}{\cos^2\theta}$.

47. 1 degree =

   A. $\dfrac{\pi}{180}$ radian .

   B. $\dfrac{180}{\pi}$ radians .

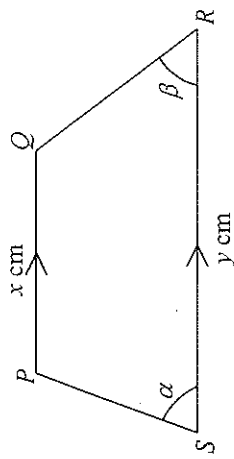   C. $\dfrac{1}{180\pi}$ radian .

   D. 180π radians .

48. The figure shows a cuboid. Which of the following are right angles?

   I. $\angle CAF$
   II. $\angle DHG$
   III. $\angle AGC$

   A. I and II only

   B. I and III only

   C. II and III only
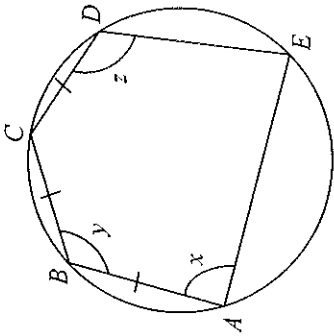
   D. I , II and III

49. In the figure, $PQ = x$ cm and $SR = y$ cm . Find PS .

   A. $\dfrac{y - x}{2\cos\alpha}$ cm

   B. $\dfrac{y}{2\cos(\alpha + \beta)}$ cm

   C. $\dfrac{x\sin\beta}{\sin\alpha}$ cm
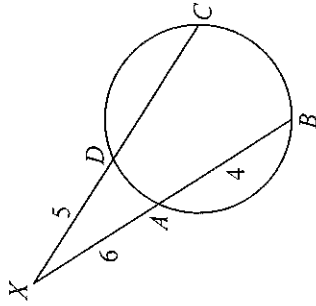
   D. $\dfrac{(y - x)\sin\beta}{\sin(\alpha + \beta)}$ cm

50. The figure shows a circle with diameter AD. If $AB=BC=CD$, find $x+y+z$.

    A.   315°

    B.   324°

    C.   330°

    D.   360°
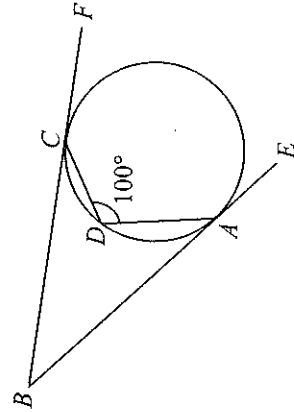
51. In the figure, XAB and XDC are straight lines. If $DX=5$, $AX=6$ and $AB=4$, find CD.

    A.   5

    B.   7

    C. $\dfrac{10}{3}$

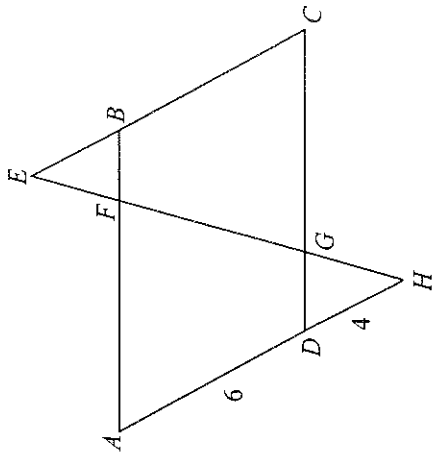   D. $\dfrac{24}{5}$

52. In the figure, BE and BF are tangents to the circle at A and C respectively. If $\angle ADC = 100°$, then $\angle ABC =$

    A.   20°.

    B.   30°.

    C.   40°.

    D.   50°.

53. In the figure, $ABCD$ is a parallelogram and ADH, EBC and $EFGH$ are straight lines. If $AD=6$, $DH=4$ and $EB:BC=3:4$, then $EF:GH=$

    A. $1:1$.

    B. $3:4$.

    C. $5:4$.

    D. $9:8$.

54. The circle $(x-4)^2 + y^2 = 36$ intersects the positive x-axis and positive y-axis at A and B respectively. Find AB.

    A. $\sqrt{30}$

    B. $2\sqrt{30}$

    C. $\sqrt{34}$

    D. $2\sqrt{34}$

END OF PAPER