FORMULAS FOR REFERENCE

SPHERE	Surface area	=	$4\pi r^2$
	Volume	=	$\frac{4}{3}\pi r^3$
CYLINDER	Area of curved surface	=	$2\pi rh$
	Volume	=	$\pi r^2 h$
CONE	Area of curved surface	=	πrl
	Volume	=	$\frac{1}{3}\pi r^2 h$
PRISM	Volume	=	base area × height
PYRAMID	Volume	=	$\frac{1}{3}$ × base area × 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.

Section A

1. If $x = \frac{y(z-3)}{3z}$, then $z =$

   A. $\frac{3}{3x-y}$.

   B. $\frac{-3}{3x-y}$.

   C. $\frac{3y}{3x-y}$.

   D. $\frac{-3y}{3x-y}$.

   E. $\frac{3x-y}{3y}$.

2. If $f(x) = x^2 - 3x - 1$, then $f(a) + f(-a) =$

   A. $2a^2$.

   B. $2a^2 - 2$.

   C. $6a$.

   D. $-6a$.

   E. -2.

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3. Solve $x^2+5x-6\le 0$.

A. $-6\le x\le 1$

B. $-3\le x\le -2$

C. $-1\le x\le 6$

D. $x\le -6$ or $x\ge 1$

E. $x\le -1$ or $x\ge 6$

4. Solve the simultaneous equations:

$$\begin{cases} 2x+\dfrac{3}{y}=-1 \\ x-\dfrac{1}{y}=7 \end{cases}.$$

A. $(0,-3)$

B. $(1,-1)$

C. $(4,-\frac{1}{3})$

D. $(4,-3)$

E. $(22,-\frac{1}{15})$

5. If $(x+3)^2-(x+1)(x-3)\equiv P(x+1)+Q$, find P and Q .

A. $P=2$, $Q=4$

B. $P=2$, $Q=10$

C. $P=4$, $Q=2$

D. $P=4$, $Q=8$

E. $P=8$, $Q=4$

6. Let $f(x)=2x^3-x^2-7x+6$. It is known that $f(-2)=0$ and $f(1)=0$. $f(x)$ can be factorized as

A. $(x+1)(x+2)(2x-3)$.

B. $(x+1)(x-2)(2x+3)$.

C. $(x-1)(x+2)(2x+3)$.

D. $(x-1)(x+2)(2x-3)$.

E. $(x-1)(x-2)(2x+3)$.

7. $\dfrac{(2^m)^2}{8^m} =$

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

B. 2^{-m}.

C. 2^m.

D. 2^{m^2-3m}.

E. 2^{2m^2-3m}.

8. Factorize $x^2 - y^2 + 2x + 1$.

A. $(x+y+1)(x+y-1)$

B. $(x+y+1)(x-y+1)$

C. $(x+y-1)(x-y+1)$

D. $(x+y-1)(x-y-1)$

E. $(x-y+1)(x-y-1)$

9. If the equation $x^2 - 6x + k = 0$ has real roots, find all possible values of k.

A. $k \geq 9$

B. $k \geq -9$

C. $k = 9$

D. $k \leq 9$

E. $k \leq -9$

10. Solve $(x-1)(x-3) = x-3$.

A. $x = 1$

B. $x = 2$

C. $x = 0$ or 3

D. $x = 1$ or 3

E. $x = 2$ or 3

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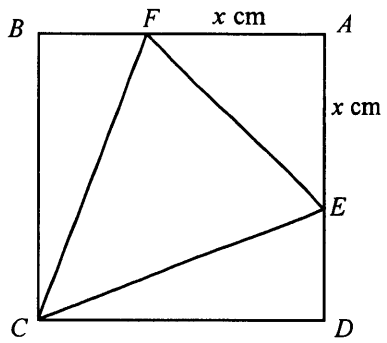
11. In the figure, $ABCD$ is a square of side 10 cm. If $AE = AF$ and the area of ΔCEF is 20 cm^2, which of the following equations can be used to find AF?



A. $x^2 + 10(10 - x) + 20 = 100$

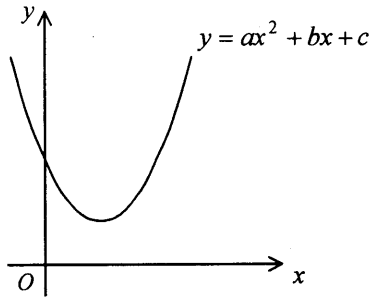
B. $x^2 + 20(10 - x) + 20 = 100$

C. $\frac{1}{2}x^2 + 10x + 20 = 100$

D. $\frac{1}{2}x^2 + 10(10 - x) + 20 = 100$

E. $\frac{1}{2}x^2 + \frac{10(10 - x)}{2} + 20 = 100$

12. The figure shows the graph of $y = ax^2 + bx + c$. Which of the following is true?



A. $a > 0$, $c > 0$ and $b^2 - 4ac > 0$

B. $a > 0$, $c > 0$ and $b^2 - 4ac < 0$

C. $a > 0$, $c < 0$ and $b^2 - 4ac < 0$

D. $a < 0$, $c > 0$ and $b^2 - 4ac > 0$

E. $a < 0$, $c < 0$ and $b^2 - 4ac > 0$

13. If a, b, c, d are consecutive terms of an arithmetic sequence, which of the following must be true?

I. $b - a = d - c$
II. d, c, b, a are consecutive terms of an arithmetic sequence
III. $a < b < c < d$

A. I only

B. I and II only

C. I and III only

D. II and III only

E. I, II and III

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14. A man bought a box of 200 apples for $500. 10 of the apples were rotten and the rest were sold at $4 each. Find his percentage profit correct to 2 significant figures.

A. 34%

B. 38%

C. 52%

D. 57%

E. 60%

15. If $\frac{x+2y}{3x-4y}=5$, then $x:y=$

A. 3:7.

B. 7:3.

C. 7:11.

D. 9:7.

E. 11:7.

16. If $\frac{a}{b}=\frac{c}{d}$, which of the following must be true?

I. $\frac{a}{c}=\frac{b}{d}$

II. $\frac{a+b}{b}=\frac{c+d}{d}$

III. $\frac{a-b}{b}=\frac{c-d}{d}$

A. I only

B. I and II only

C. I and III only

D. II and III only

E. I, II and III

17. If x varies inversely as y and directly as z^2, then

A. $\frac{x}{yz^2}$ is a constant.

B. $\frac{xy}{z^2}$ is a constant.

C. $\frac{xz^2}{y}$ is a constant.

D. $\frac{z^2}{y}$ is a constant.

E. $\frac{1}{y}+z^2$ is a constant.

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18. In the figure, OAB is an equilateral triangle. Find the bearing of B from A.

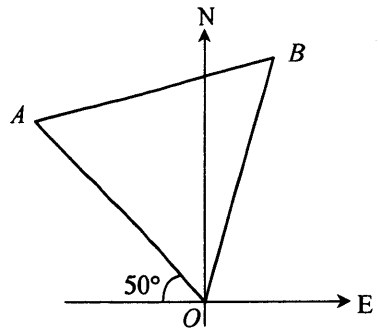
A. 10°

B. 80°

C. 170°

D. 260°

E. 350°



19. In the figure, the radii of the two circles are 3 cm and 1 cm respectively. Find the ratio of the area of the shaded part to that of the smaller circle.

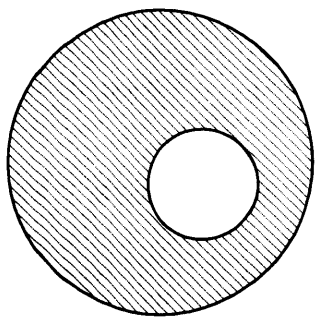
A. 2 : 1

B. 3 : 1

C. 4 : 1

D. 8 : 1

E. 9 : 1



20. The figure shows a right circular cone of base radius 4 cm and height 3 cm. Find the area of its curved surface.

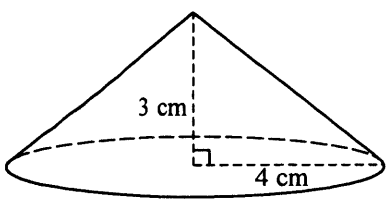
A. 12π cm^2

B. 16π cm^2

C. 20π cm^2

D. 24π cm^2

E. 48π cm^2



21. In the figure, find the area of the pentagon $ABCDE$.

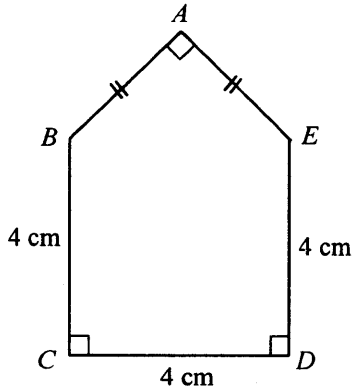
A. 16 cm^2

B. 18 cm^2

C. 20 cm^2

D. 24 cm^2

E. 32 cm^2



22. The figure shows a test tube consisting of a cylindrical upper part of radius 1 cm and a hemispherical lower part of the same radius. If the height of the test tube is 12 cm, find its capacity.

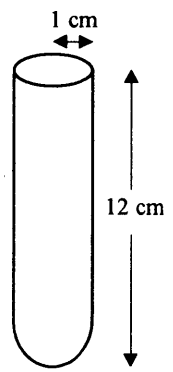
A. $\frac{35}{3}\pi$ cm^3

B. $\frac{37}{3}\pi$ cm^3

C. $\frac{38}{3}\pi$ cm^3

D. $\frac{40}{3}\pi$ cm^3

E. $\frac{68}{3}\pi$ cm^3



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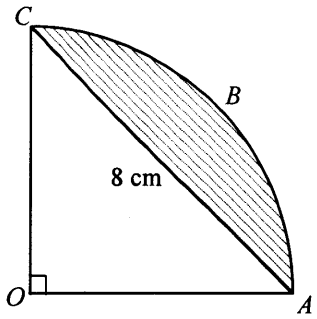
23. In the figure, $OABC$ is a sector. Find the area of the shaded region.



A. $(\pi - 2)\ \text{cm}^2$

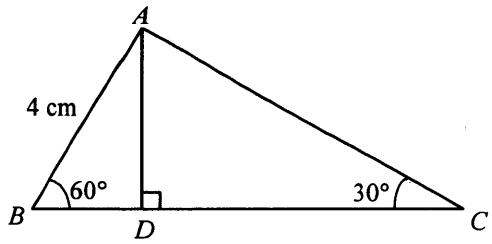
B. $(2\pi - 4)\ \text{cm}^2$

C. $(4\pi - 8)\ \text{cm}^2$

D. $(8\pi - 8)\ \text{cm}^2$

E. $(8\pi - 16)\ \text{cm}^2$

24. In the figure, find CD.



A. 6 cm

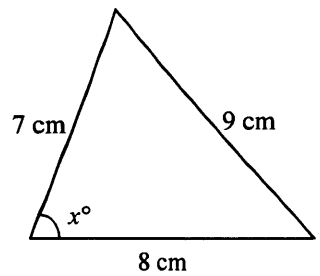
B. 4 cm

C. $4\sqrt{3}$ cm

D. $2\sqrt{3}$ cm

E. $\dfrac{2\sqrt{3}}{3}$ cm

25. In the figure, find x correct to 3 significant figures.



A. 48.2

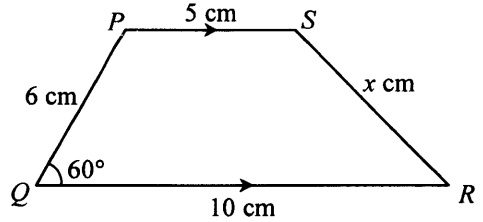
B. 55.1

C. 58.4

D. 67.5

E. 73.4

26. In the figure, $PQRS$ is a trapezium. Find x correct to 3 significant figures.



A. 3.01

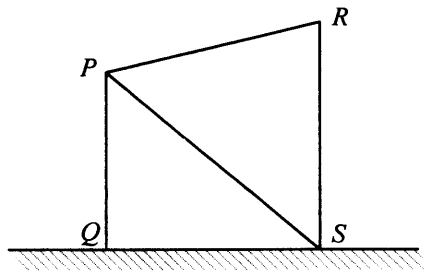
B. 5.57

C. 5.77

D. 6.00

E. 9.54

27. In the figure, PQ and RS are two vertical poles standing on the horizontal ground. The angle of elevation of R from P is $20°$ and the angle of depression of S from P is $40°$. If $RS = 5$ m, then $PR =$



A. $\dfrac{5\sin 40°}{\sin 70°}$ m.

B. $\dfrac{5\sin 50°}{\sin 60°}$ m.

C. $\dfrac{5\sin 60°}{\sin 50°}$ m.

D. $\dfrac{5\sin 70°}{\sin 40°}$ m.

E. $\dfrac{5}{\sin 50° \sin 60°}$ m.

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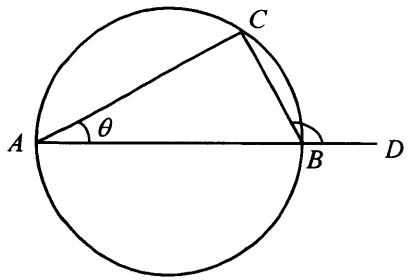
28. In the figure, AB is a diameter of the circle and ABD is a straight line. $\angle CBD =$



A. 2θ.

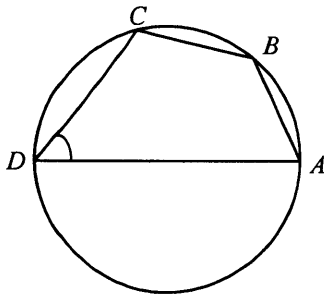
B. 4θ.

C. $90° + \theta$.

D. $180° - \theta$.

E. $180° - 2\theta$.

29. In the figure, AD is a diameter of the circle. If $\overset{\frown}{AB} : \overset{\frown}{BC} : \overset{\frown}{CD} = 3:5:7$, then $\angle ADC =$



A. $36°$.

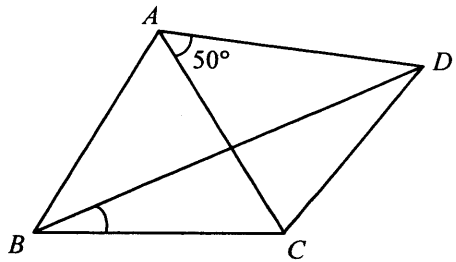
B. $45°$.

C. $48°$.

D. $49°$.

E. $72°$.

30. In the figure, $AB = BC = CA = CD$. Find $\angle CBD$.



A. $20°$

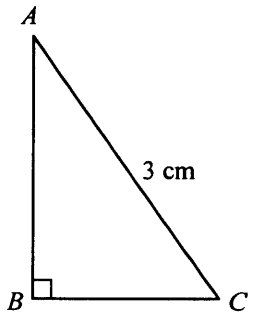
B. $25°$

C. $27.5°$

D. $30°$

E. $35°$

31. In the figure, $AB = 2BC$. Find BC correct to 3 significant figures.



A. 0.775 cm

B. 1.00 cm

C. 1.34 cm

D. 1.73 cm

E. 1.80 cm

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32. Find the equation of the straight line passing through $(-1, 1)$ and parallel to $5x+4y=0$.

A. $4x-5y+9=0$

B. $4x+5y+1=0$

C. $5x-4y+9=0$

D. $5x+4y-1=0$

E. $5x+4y+1=0$

33. In the figure, $PQRS$ is a parallelogram. Find the slope of PR .

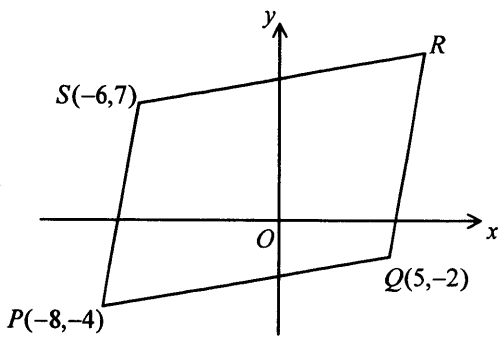
A. $\frac{13}{15}$

B. $\frac{15}{13}$

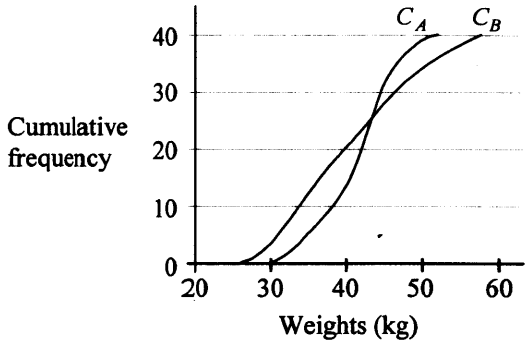
C. $\frac{9}{11}$

D. $\frac{11}{9}$

E. -5



34. In the figure, C_A and C_B are the cumulative frequency curves of two distributions of weights A and B respectively. Which of the following is/are true?



I. median of A > median of B
II. range of A > range of B
III. inter-quartile range of A > inter-quartile range of B

A. I only

B. I and II only

C. I and III only

D. II and III only

E. I, II and III

Go on to the next page

35. Two cards are drawn randomly from five cards numbered 2 , 2 , 3 , 5 and 5 respectively. Find the probability that the sum of the numbers on the cards drawn is 5 .

A. $\frac{1}{5}$

B. $\frac{2}{5}$

C. $\frac{1}{10}$

D. $\frac{2}{25}$

E. $\frac{4}{25}$

36. In a shooting game, the probability that Mr. Tung will hit the target is $\frac{2}{3}$. If he shoots twice, find the probability that he will hit the target at least once.

A. $\frac{1}{9}$

B. $\frac{2}{9}$

C. $\frac{4}{9}$

D. $\frac{2}{3}$

E. $\frac{8}{9}$

Section B

37. Let a and b be two consecutive positive integers. Which of the following must be true?

I. $a+b$ is odd.
II. ab is odd.
III. a^2+b^2 is odd.

A. III only

B. I and II only

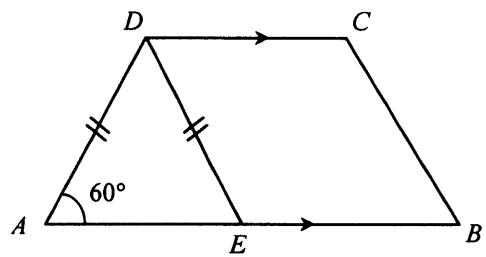
C. I and III only

D. II and III only

E. I, II and III

38. In the figure, $ABCD$ is a trapezium. Which of the following must be true?

I. AED is an equilateral triangle
II. $EBCD$ is a parallelogram
III. $AB = 2DC$



A. I only

B. II only

C. I and II only

D. I and III only

E. I, II and III

39. $\dfrac{2}{x^2-1}-\dfrac{3}{x^2-x-2}=$

A. $\dfrac{-1}{(x-1)(x-2)}$.

B. $\dfrac{-1}{(x+1)(x-2)}$.

C. $\dfrac{-1}{(x+1)(x+2)}$.

D. $\dfrac{-1}{(x-1)(x+1)(x-2)}$.

E. $\dfrac{-x-7}{(x-1)(x+1)(x-2)}$.

40. Suppose $\log_{10} 2=a$ and $\log_{10} 3=b$. Express $\log_{10} 15$ in terms of a and b.

A. $-a+b+1$

B. $-a+10b$

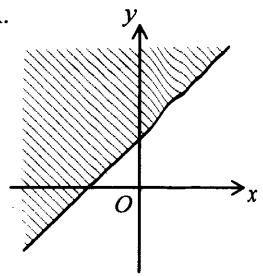
C. $a+2b$

D. $(a+b)b$

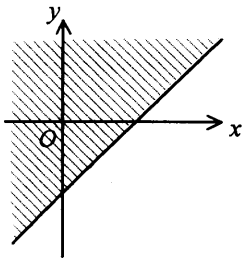
E. $\dfrac{10b}{a}$

41. If $b<0$ and $c<0$, which of the following shaded regions may represent the solution of $x+by+c\geq 0$?

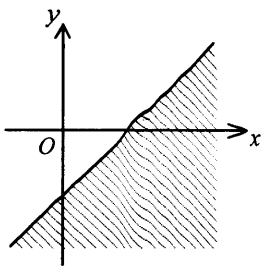
A.



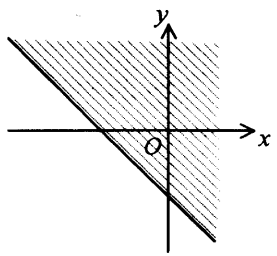
B.



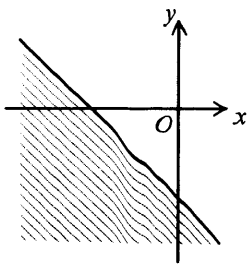
C.



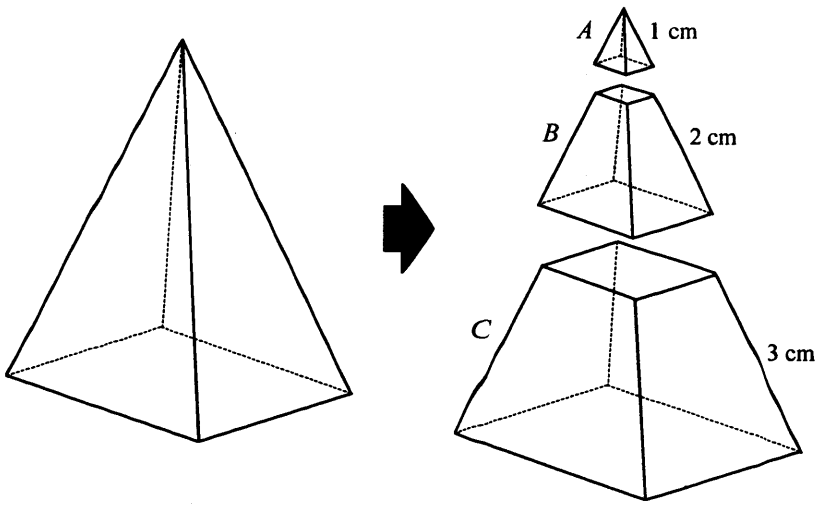
D.



E.



42. In the figure, a right pyramid with a square base is divided into three parts A, B and C by two planes parallel to the base such that the lengths of their slant edges are 1 cm, 2 cm and 3 cm respectively.



Find volume of A : volume of B : volume of C.

A. 1 : 2 : 3

B. 1 : 4 : 9

C. 1 : 8 : 27

D. 1 : 26 : 189

E. 1 : 27 : 216

43. Find the sum to infinity of the geometric sequence $-1, \frac{1}{x}, -\frac{1}{x^2}, \frac{1}{x^3}, \ldots$, where $x > 1$.

A. $\frac{-1}{x-1}$

B. $\frac{-1}{x+1}$

C. $\frac{-x}{x-1}$

D. $\frac{-x}{x+1}$

E. $\frac{x}{x+1}$

44. $\frac{1+\sin\theta}{\cos\theta} + \frac{\cos\theta}{1+\sin\theta} =$

A. 1.

B. $2(1+\sin\theta)$.

C. $\frac{2}{\cos\theta}$.

D. $\frac{2}{\cos\theta(1+\sin\theta)}$.

E. $\frac{1+\sin\theta+\cos\theta}{\cos\theta(1+\sin\theta)}$.

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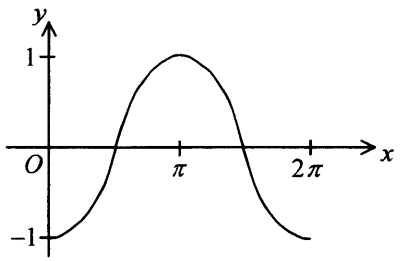
45. The figure shows the graph of the function



A. $y = \cos x$.

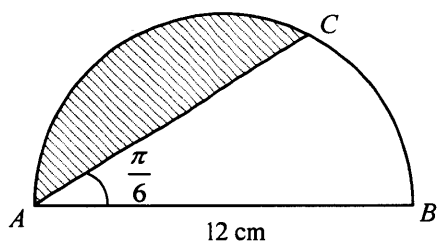
B. $y = \cos(-x)$.

C. $y = \cos(\frac{\pi}{2} - x)$.

D. $y = \cos(\frac{\pi}{2} + x)$.

E. $y = \cos(\pi - x)$.

46. In the figure, ABC is a semicircle. Find the area of the shaded part.



A. 6π cm^2

B. 15π cm^2

C. $(6\pi - 9\sqrt{3})$ cm^2

D. $(6\pi + 9\sqrt{3})$ cm^2

E. $(12\pi - 9\sqrt{3})$ cm^2

47. For $0° \le x \le 360°$, how many roots does the equation $3\sin^2 x + 2\sin x - 1 = 0$ have?

A. 0

B. 1

C. 2

D. 3

E. 4

48. The figure shows a right pyramid with a square base $ABCD$. Let θ be the angle between the planes VAB and VCD. Find $\sin\frac{\theta}{2}$.

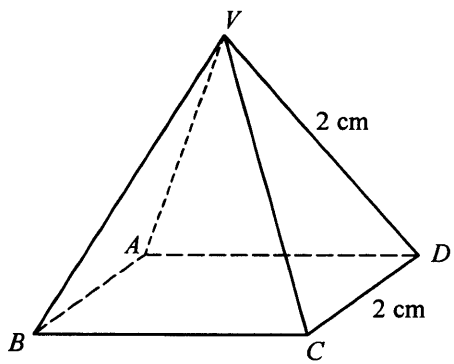
A. $\frac{1}{2}$

B. $\frac{\sqrt{3}}{2}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{\sqrt{5}}$

E. $\frac{2}{\sqrt{5}}$



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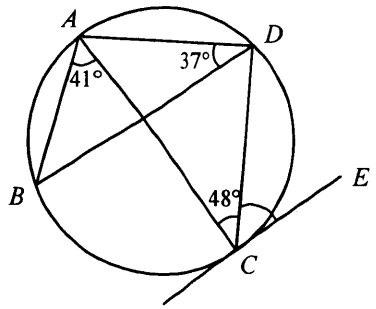
49. In the figure, CE is tangent to the circle at C. Find $\angle DCE$.



A. 40°

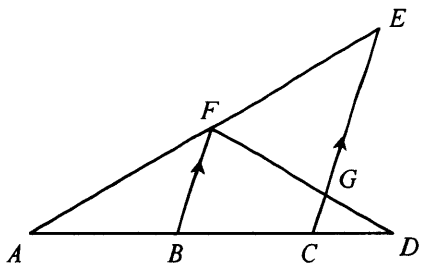
B. 42°

C. 49°

D. 54°

E. 78°

50. In the figure, $ABCD$, AFE, CGE and FGD are straight lines. If $AB = BC = 2CD$, then $CG : GE =$



A. $1:2$.

B. $1:3$.

C. $1:4$.

D. $1:5$.

E. $1:6$.

51. Find the mean deviation of the five numbers $x-2$, $x-1$, x, $x+1$ and $x+2$.

A. x

B. 0

C. $\frac{6}{5}$

D. $\sqrt{2}$

E. $\frac{\sqrt{30}}{5}$

52. The circle $x^2 + y^2 - 2x - 7y - 8 = 0$ intersects the x-axis at A and B. Find the length of AB.

A. 2

B. 6

C. 7

D. 9

E. $\sqrt{85}$

Go on to the next page

53. The equations of two circles are

$x^2 + y^2 + ax - by = 0$ and

$x^2 + y^2 - ax + by = 0$.

Which of the following must be true?

I. The two circles have the same centre.
II. The two circles have equal radii.
III. The line joining the centres of the two circles passes through the origin.

A. I only

B. II only

C. III only

D. I and II only

E. II and III only

54. $A(7, 14)$ and $B(1, 2)$ are two points. C is a point on AB produced such that $AB : BC = 2 : 1$. Find the coordinates of C .

A. $(-5, -10)$

B. $(-2, -4)$

C. $(3, 6)$

D. $(5, 10)$

E. $(10, 20)$

END OF PAPER