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	=	$\pi r l$
	Volume	=	$\frac{1}{3}\pi r^2 h$
PRISM	Volume	=	base area × height
PYRAMID	Volume	=	$\frac{1}{3}$ × base area × height

There are 54 questions in this paper.
The diagrams in this paper are not necessarily drawn to scale.

1. Evaluate $1.15 \div 15$ correct to 3 significant figures.

   A. 0.076

   B. 0.077

   C. 0.0766

   D. 0.0767

   E. 0.076

2. $\frac{27^x}{3^y} =$

   A. $\frac{9x}{y}$.

   B. $9^{\frac{x}{y}}$.

   C. 9^{x-y}.

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

   E. 3^{3x-y}.

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3. Find the L.C.M. of $4x^2yz$ and $6xy^3$.

A. $2xy$

B. $12x^2y^3$

C. $12x^2y^3z$

D. $24x^2y^3z$

E. $24x^3y^4z$

4. If $A = 2\pi r^2 + 2\pi rh$, then $h =$

A. $A - r$.

B. $\frac{A}{r}$.

C. $\frac{A}{2\pi r} - r$.

D. $r - \frac{A}{2\pi r}$.

E. $\frac{A}{2\pi r} - 2\pi r^2$.

5. Find the remainder when $x^3 - x^2 + 1$ is divided by $2x + 1$.

A. -11

B. $\frac{5}{8}$

C. $\frac{7}{8}$

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

E. 5

6. Which of the following expressions has/have $b - c$ as a factor?

I. $ab - ac$
II. $a(b - c) - b + c$
III. $a(b - c) - b - c$

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

7. Solve $1 < -3x + 4 < 10$.

A. $-2 < x < 1$

B. $-1 < x < 2$

C. $x < -2$ or $x > 1$

D. $x < -1$ or $x > 2$

E. no solution

8. If $\frac{2}{x^2-1} \equiv \frac{a}{x+1} + \frac{b}{x-1}$, find a and b.

A. $a = 2,\ b = 1$

B. $a = 1,\ b = 2$

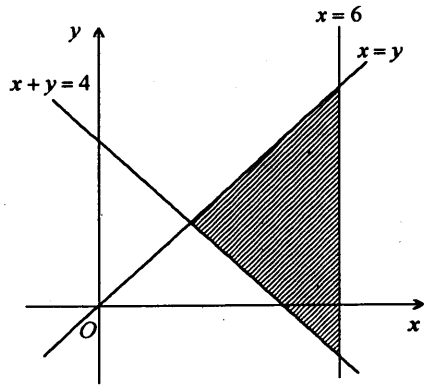
C. $a = 1,\ b = 1$

D. $a = 1,\ b = -1$

E. $a = -1,\ b = 1$

9. In the figure, (x, y) is any point in the shaded region (including the boundary). Which of the following is/are true?

I. $x \le y$
II. $x + y \le 4$
III. $x \le 6$



A. I only

B. II only

C. III only

D. I and III only

E. II and III only

10. Solve $\begin{cases} x^2 + y^2 = 13 \\ x + y = 1 \end{cases}$.

A. $\begin{cases} x = -2 \\ y = 3 \end{cases}$

B. $\begin{cases} x = -6 \\ y = 7 \end{cases}$

C. $\begin{cases} x = 2 \\ y = -1 \end{cases}$ or $\begin{cases} x = -3 \\ y = 4 \end{cases}$

D. $\begin{cases} x = -2 \\ y = 3 \end{cases}$ or $\begin{cases} x = 3 \\ y = -2 \end{cases}$

E. $\begin{cases} x = -6 \\ y = 7 \end{cases}$ or $\begin{cases} x = 7 \\ y = -6 \end{cases}$

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11. If α and β are the roots of the equation $2x^2+4x-3=0$, find $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}$.

A. $-\frac{22}{3}$

B. $-\frac{16}{3}$

C. $-\frac{14}{3}$

D. $-\frac{8}{3}$

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

12. Find the n-th term of the A.P. 4, 2, 0, −2, ...

A. $2+2n$

B. $4-2n$

C. $4+2n$

D. $6-2n$

E. $(5-n)n$

13. The sum to infinity of a G.P. is 2. If the first term is $\frac{3}{2}$, find the common ratio.

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

B. $-\frac{1}{4}$

C. $\frac{1}{4}$

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

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

14. Shop A offers a 10% discount on a book marked at $\$P$. Shop B offers a 15% discount on the same book marked at $\$Q$. If the selling price of the book is the same in both shops, express Q in terms of P.

A. $Q=P+5$

B. $Q=\frac{17}{18}P$

C. $Q=\frac{20}{21}P$

D. $Q=\frac{21}{20}P$

E. $Q=\frac{18}{17}P$

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15. In the figure, area of ΔACD : area of ΔBCD =

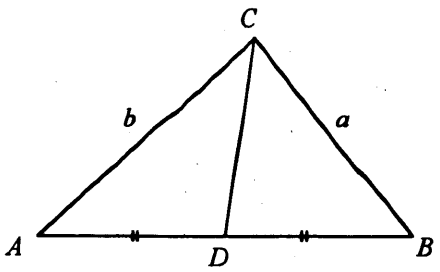
A. $1:1$.

B. $a:b$.

C. $b:a$.

D. $a^2:b^2$.

E. $b^2:a^2$.



16. In the figure, O is the centre of the circle. AB and AC are tangents to the circle at B and C respectively. Area of the shaded region =

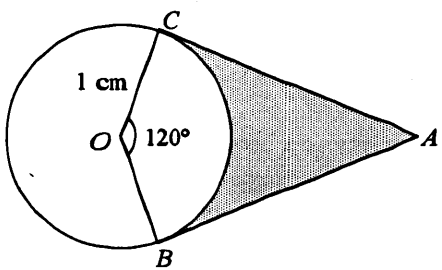
A. $(2-\frac{\pi}{6})\ \text{cm}^2$.

B. $(2-\frac{\pi}{3})\ \text{cm}^2$.

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

D. $(\sqrt{3}-\frac{\pi}{3})\ \text{cm}^2$.

E. $(\frac{\sqrt{3}}{2}-\frac{\pi}{6})\ \text{cm}^2$.



17. In the figure, the area of $ABCD$ is

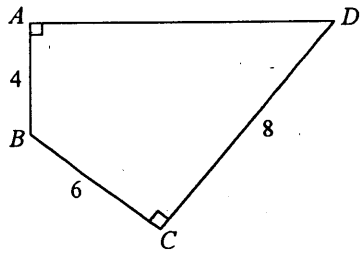
A. 36.

B. 40.

C. 44.

D. $4\sqrt{21}+24$.

E. $4\sqrt{29}+24$.



18. In the figure, A and B are two right solid cylinders with the same base radius 1. If the heights of A and B are 1 and 2 respectively, find $\frac{\text{the total surface area of A}}{\text{the total surface area of B}}$.

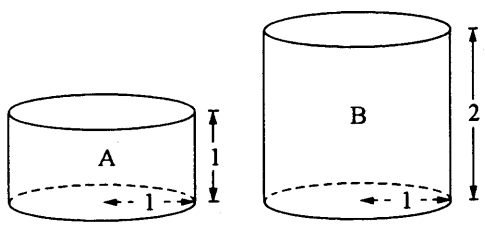
A. $\frac{1}{8}$

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

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

D. $\frac{3}{5}$

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



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19. If $0° \le \theta \le 360°$, solve $2\sin\theta = -\sqrt{3}$.

A. 120° or 240°

B. 120° or 300°

C. 150° or 330°

D. 210° or 330°

E. 240° or 300°

20. $\dfrac{\dfrac{1}{\cos\theta} - \cos\theta}{\tan^2\theta} =$

A. $\sin\theta$.

B. $\cos\theta$.

C. $\cos^2\theta$.

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

E. $\dfrac{1}{\tan\theta}$.

21. The figure shows the graph of $y = \frac{1}{2}\cos 2x$. The point P is

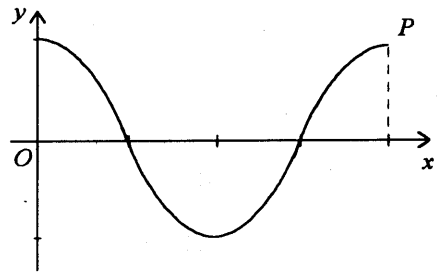
A. $(\frac{\pi}{2}, 2)$.

B. $(\pi, \frac{1}{2})$.

C. $(\pi, 1)$.

D. $(2\pi, \frac{1}{2})$.

E. $(2\pi, 1)$.



22. If $0 \le x \le \pi$, solve $2\sin x + 3\cos x = 0$ correct to 3 significant figures.

A. 0.588

B. 0.983

C. 2.16

D. 2.55

E. no solution

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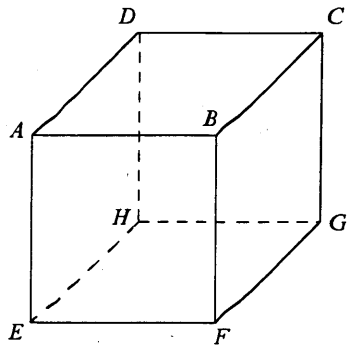
23. The figure shows a cube. Which of the following is/are equal to $\angle AGE$?

I. $\angle AGF$
II. $\angle BDF$
III. $\angle DEG$



A. I only.

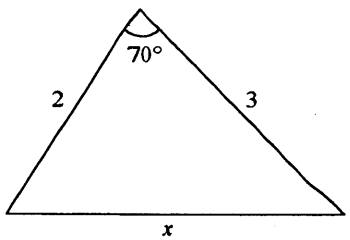
B. II only.

C. III only.

D. I and II only.

E. II and III only.

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



A. 2.71

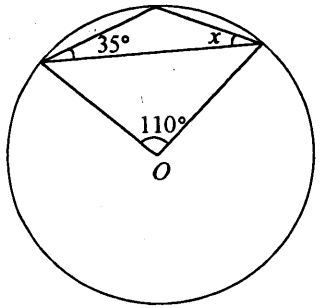
B. 2.98

C. 3.31

D. 3.88

E. 4.14

25. In the figure, O is the centre of the circle. Find x.



A. 20°

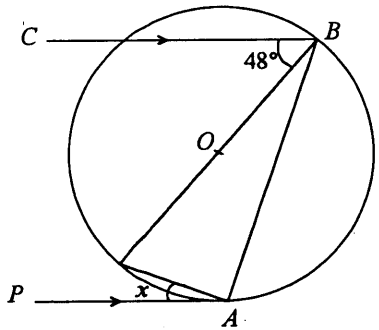
B. 27.5°

C. 35°

D. 37.5°

E. 40°

26. In the figure, O is the centre of the circle. PA is the tangent to the circle at A and $CB // PA$. Find x.



A. 21°

B. 24°

C. 42°

D. 45°

E. 48°

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27. The figure shows a right circular cylinder with AC being a diameter of its upper face. AB and CD are two vertical lines on the curved surface. A curve is drawn on the surface of the cylinder from B to C. Find its shortest possible length.

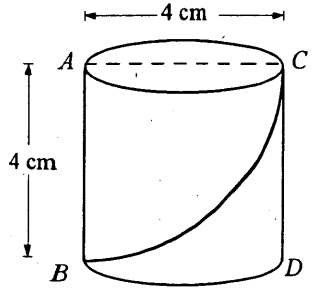
A. 2π cm

B. $2\sqrt{\pi^2+4}$ cm

C. $4\sqrt{2}$ cm

D. $4\sqrt{\pi^2+1}$ cm

E. $4\sqrt{\pi^2+4}$ cm



28. In the figure, $ABCDE$ is a regular pentagon and ABF is an equilateral triangle. Find x.

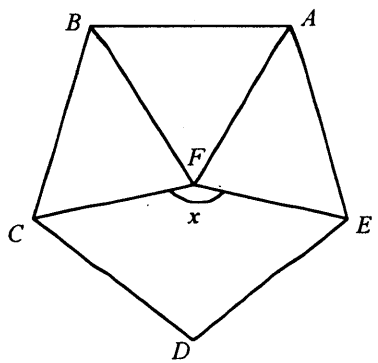
A. 120°

B. 126°

C. 144°

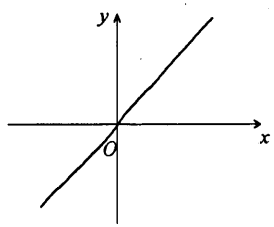
D. 156°

E. 168°

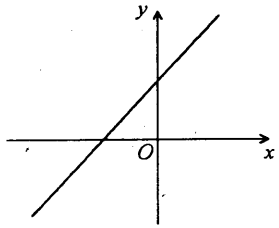


29. If a, b and c are all positive, which of the following may represent the graph of $ax+by+c=0$?

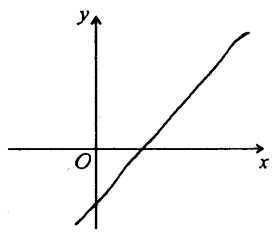
A.



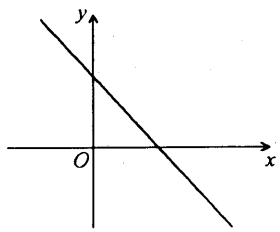
B.



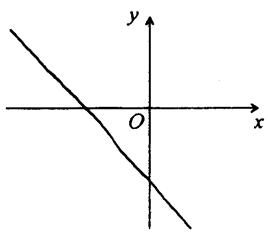
C.



D.



E.



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30. The equation of the circle centred at (a, b) and tangential to the x-axis is

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

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

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

D. $x^2 + y^2 + 2ax + 2by + a^2 = 0$.

E. $x^2 + y^2 + 2ax + 2by + b^2 = 0$.

31. Find the equation of the straight line which passes through $(3, -1)$ and is perpendicular to $2x - y + 1 = 0$.

A. $x + 2y - 1 = 0$

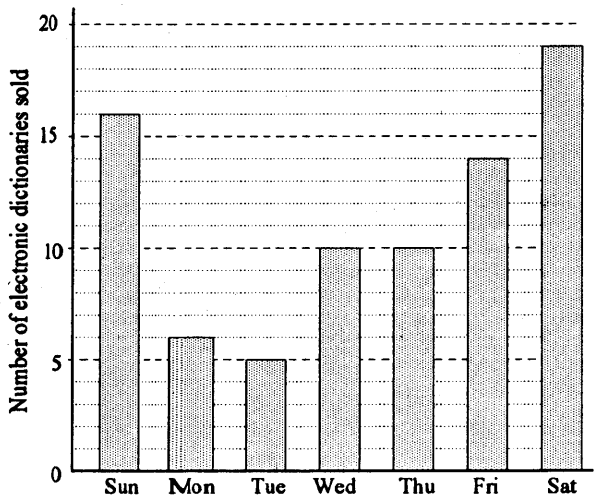
B. $x + 2y + 1 = 0$

C. $x - 2y - 5 = 0$

D. $2x + y - 5 = 0$

E. $2x - y - 7 = 0$

32. **The bar chart below shows the number of electronic dictionaries sold in a shop last week:**



Of those electronic dictionaries sold last week, what percentage were sold on Sunday?

A. 16%

B. 18%

C. 20%

D. 22.5%

E. 25%

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33. Which of the following *cannot* be read directly from a cumulative frequency curve?

I. Mean
II. Median
III. Mode

A. I only

B. II only

C. I and II only

D. I and III only

E. II and III only

34. There are 10 parcels. Two of them contain one pen each. If a man opens the parcels at random, what is the probability that he can find the two pens by opening two parcels only?

A. $\frac{1}{25}$

B. $\frac{1}{45}$

C. $\frac{1}{50}$

D. $\frac{1}{90}$

E. $\frac{1}{100}$

35. In a certain game, the probability that John will win is 0.3 . If he plays the game 3 times, find the probability that he will win at least once.

A. 0.147

B. 0.441

C. 0.657

D. 0.9

E. 0.973

36. Simplify $\frac{1}{x-1}+\frac{1}{x+1}+\frac{3x-1}{1-x^2}$.

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

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

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

D. $\frac{3x+1}{1-x^2}$

E. $\frac{1-5x}{1-x^2}$

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37. m and n are multiples of 3 and 4 respectively. Which of the following must be true?

I. mn is a multiple of 12.
II. The H.C.F. of m and n is even.
III. The L.C.M. of m and n is even.

A. I only

B. I and II only

C. I and III only

D. II and III only

E. I, II and III

38. Let $x > y > 0$. If $\log(x+y) = a$ and $\log(x-y) = b$, then $\log\sqrt{x^2 - y^2} =$

A. $\frac{a+b}{2}$.

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

C. $\sqrt{a+b}$.

D. $\sqrt{ab}$.

E. $\sqrt{a} + \sqrt{b}$.

39. If $\left(\frac{\sqrt{3}}{3} - \frac{1}{2}\right)x = 1$, then $x =$

A. $-\frac{\sqrt{3}}{3} + \frac{1}{2}$.

B. $\frac{\sqrt{3}}{3} + \frac{1}{2}$.

C. $-4\sqrt{3} - 6$.

D. $4\sqrt{3} - 6$.

E. $4\sqrt{3} + 6$.

40. If 3 is a root of the equation $x^2 - x + c = 0$, solve $x^2 - x + c > 0$.

A. $x < -2$ or $x > 3$

B. $x < 2$ or $x > 3$

C. $x > -6$

D. $-2 < x < 3$

E. $2 < x < 3$

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41. The curve in the figure is the graph of $y = -x^2 + bx + c$. Find the area of the rectangle $OPQR$.

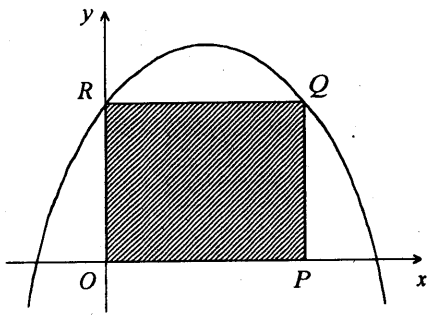
A. bc

B. b^2

C. c^2

D. $b^2 - 4c$

E. $b^2 + 4c$



42. If the common difference of the A.P. a_1, a_2, a_3, ... is d, then the common difference of the A.P. $2a_1 + 3$, $2a_2 + 3$, $2a_3 + 3$, ... is

A. 2.

B. 3.

C. d.

D. $2d$.

E. $2d + 3$.

43. The length of a rectangle is decreased by 20%. If the area remains unchanged, find the percentage increase of its width.

A. $1\frac{1}{4}\%$

B. $12\frac{1}{2}\%$

C. $16\frac{2}{3}\%$

D. 20%

E. 25%

44. The following table shows the compositions of Tea A and Tea B which are mixtures of Chinese tea and Indian tea:

	Ratio of Chinese tea and Indian tea by weight
Tea A	3 : 1
Tea B	2 : 3

If 4 kg of tea A and 10 kg of tea B are mixed, find the ratio of Chinese tea and Indian tea in the mixture.

A. 2 : 5

B. 16 : 17

C. 1 : 1

D. 5 : 4

E. 23 : 17

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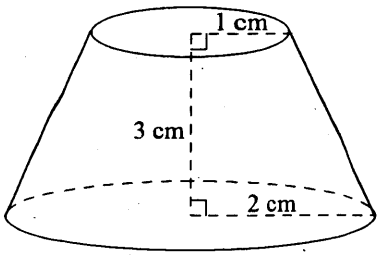
45. The figure shows a frustum of a right circular cone. The radii of the upper face and the base are 1 cm and 2 cm respectively. If the height is 3 cm, find the volume.



A. 3π cm^3

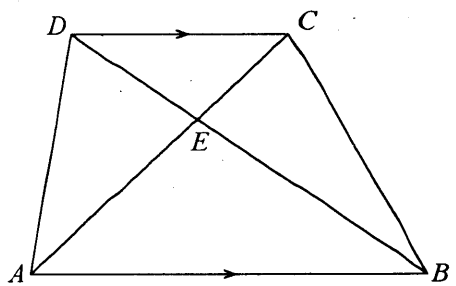
B. $\frac{9}{2}\pi$ cm^3

C. $\frac{11}{2}\pi$ cm^3

D. 7π cm^3

E. $\frac{15}{2}\pi$ cm^3

46. In the figure, if $\frac{\text{Area of triangle } CDE}{\text{Area of triangle } BCE} = \frac{1}{2}$, find $\frac{\text{Area of triangle } CDE}{\text{Area of trapezium } ABCD}$.



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

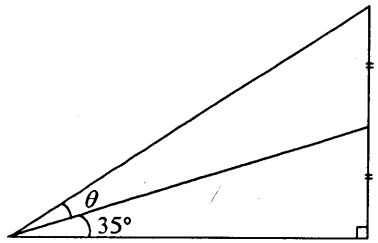
B. $\frac{1}{9}$

C. $\frac{1}{8}$

D. $\frac{1}{7}$

E. $\frac{1}{6}$

47. In the figure, find θ correct to the nearest degree.



A. 16°

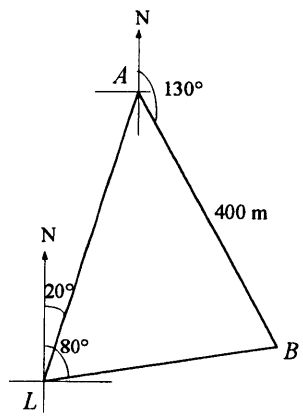
B. 19°

C. 26°

D. 35°

E. 36°

48. In the figure, the bearings of two ships A and B from a lighthouse L are 020° and 080° respectively. B is 400 m and at a bearing of 130° from A. Find the distance of B from L.



A. 400 m

B. $\frac{400}{\sin 60°}$ m

C. $\frac{400 \sin 50°}{\sin 60°}$ m

D. $\frac{400 \sin 70°}{\sin 60°}$ m

E. $\frac{400 \sin 70°}{\sin 80°}$ m

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49. The figure shows a right prism with a right-angled triangle as the cross-section. Find the angle between the line BF and the plane $ABCD$ correct to the nearest degree.

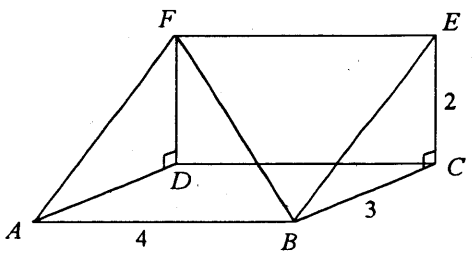
A. 22°

B. 34°

C. 37°

D. 42°

E. 56°



50. In the figure, O is the centre of the circle. AP, AB and BR are tangents to the circle at P, Q and R respectively. Which of the following must be true?

I. $AP + BR = AB$

II. OQ bisects $\angle AOB$

III. $\angle AOB = \frac{1}{2}\angle POR$

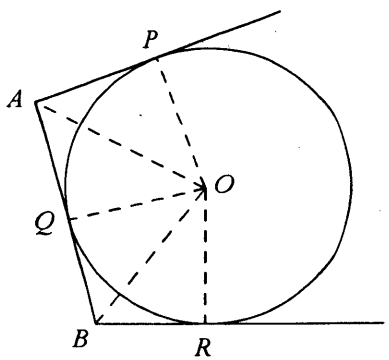
A. I only

B. II only

C. I and II only

D. I and III only

E. I, II and III



51. In the figure, $ABCD$ is a trapezium with $AB // DC$. AH bisects $\angle BAD$ and DH bisects $\angle ADC$. Which of the following must be true?

I. $\angle AHD = 90°$

II. $\angle ADC = \angle BCD$

III. $\angle BAD + \angle BCD = 180°$

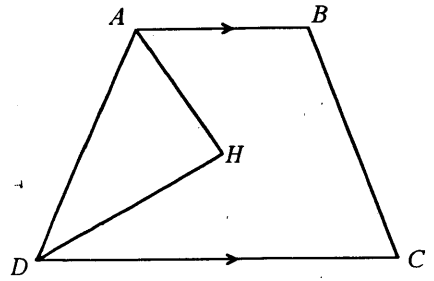
A. I only

B. II only

C. III only

D. I and III only

E. II and III only



52. In the figure, $DE : EF =$

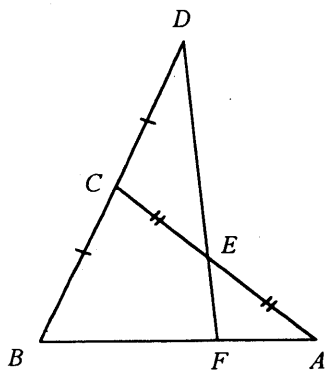
A. 1 : 1.

B. 2 : 1.

C. 3 : 1.

D. 3 : 2.

E. 4 : 1.



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53. $A(-3, 2)$ and $B(1, 3)$ are two points. C is a point on the AB produced such that $AB : BC = 1 : 2$. Find the coordinates of C.

A. $(-\frac{5}{3}, \frac{7}{3})$

B. $(-\frac{1}{3}, \frac{8}{3})$

C. $(3, \frac{7}{2})$

D. $(5, 4)$

E. $(9, 5)$

54. $C_1 : x^2 + y^2 = 4$ and $C_2 : x^2 + y^2 = 9$ are two circles. A chord AB of C_2 touches C_1. Find the length of AB.

A. $\sqrt{5}$

B. $2\sqrt{5}$

C. $\sqrt{65}$

D. $2\sqrt{65}$

E. 10

END OF PAPER