

MATHEMATICS PAPER 2

11.15 am – 12.45 pm (1½ hours)

Subject Code 180

1. Read carefully the instructions on the Answer Sheet. Stick a barcode label and insert the information required in the spaces provided.
2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF PAPER**' after the last question.
3. All questions carry equal marks.
4. **ANSWER ALL QUESTIONS.** You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber.
5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.
6. No marks will be deducted for wrong answers.

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	$= \pi rl$
	Volume	$= \frac{1}{3}\pi r^2 h$
PRISM	Volume	$= \text{base area} \times \text{height}$
PYRAMID	Volume	$= \frac{1}{3} \times \text{base area} \times \text{height}$

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. $2^n \cdot 3^n =$

- A. 5^n .
- B. 6^n .
- C. 8^n .
- D. 9^n .

2. If $P = \frac{VT}{R} - 2$, then $T =$

- A. $\frac{P}{V} + 2R$.
- B. $\frac{RP + 2}{V}$.
- C. $R\left(\frac{P}{V} + 2\right)$.
- D. $\frac{R(P + 2)}{V}$.

3. $\frac{1}{a-2} - \frac{2}{1-a} =$

- A. $\frac{3}{(a-1)(a-2)}$.
- B. $\frac{a-3}{(a-1)(a-2)}$.
- C. $\frac{3a-1}{(a-1)(a-2)}$.
- D. $\frac{3a-5}{(a-1)(a-2)}$.

4. $(3x-5)(2x^2+5x-3) =$

- A. $6x^3 + 5x^2 - 34x + 15$.
- B. $6x^3 - 5x^2 + 34x + 15$.
- C. $6x^3 + 25x^2 + 16x + 15$.
- D. $6x^3 - 25x^2 - 16x + 15$.

5. If a and b are constants such that $a(x^2 - x) + b(x^2 + x) \equiv 2x^2 + 4x$, then $a =$

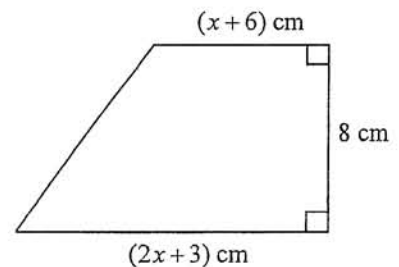
- A. -1 .
- B. 1 .
- C. 2 .
- D. 3 .

6. Let $f(x) = x^2 - 9x + c$, where c is a constant. If $f(-1) = 8$, then $c =$

- A. -2 .
- B. 0 .
- C. 16 .
- D. 18 .

7. In the figure, the area of the trapezium is 96 cm^2 . Find x .

- A. 1
- B. 5
- C. 7
- D. 11

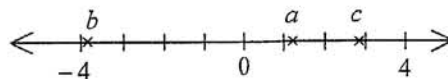


8. If the quadratic equation $x^2 + bx + 4b = 0$ has equal roots, then $b =$
- A. 4 .
 - B. 16 .
 - C. 0 or 4 .
 - D. 0 or 16 .
9. If x is a positive integer satisfying the inequality $x - 5 \leq 1 - x$, then the least value of x is
- A. 0 .
 - B. 1 .
 - C. 2 .
 - D. 3 .
10. If a dictionary is sold at its marked price, then the percentage profit is 30% . If the dictionary is sold at a 20% discount on its marked price, then the profit is \$5 . Find the cost of the dictionary.
- A. \$104
 - B. \$105
 - C. \$125
 - D. \$130
11. A sum of \$30 000 is deposited at an interest rate of 5% per annum for 2 years, compounded yearly. Find the interest correct to the nearest dollar.
- A. \$3 000
 - B. \$3 075
 - C. \$3 114
 - D. \$3 122

12. In the following sequence, the 1st term, the 2nd term and the 3rd term are 1, 2 and 3 respectively. For any positive integer n , the $(n+3)$ th term is the sum of the $(n+2)$ th term, the $(n+1)$ th term and the n th term. Find the 9th term of the sequence.

1, 2, 3, 6, 11, ...

- A. 51
 B. 68
 C. 125
 D. 230
13. The scale of a map is 1:5000. If the area of a garden on the map is 4 cm^2 , then the actual area of the garden is
- A. 100 m^2 .
 B. 200 m^2 .
 C. 10000 m^2 .
 D. 20000 m^2 .
14. It is given that y is partly constant and partly varies inversely as x . When $x=1$, $y=-1$ and when $x=2$, $y=1$. Find the value of x when $y=2$.
- A. -4
 B. 1
 C. 2.5
 D. 4
15. The figure shows the positions of three real numbers a , b and c on the number line. Which of the following is the best estimate of $c(a-b)$?

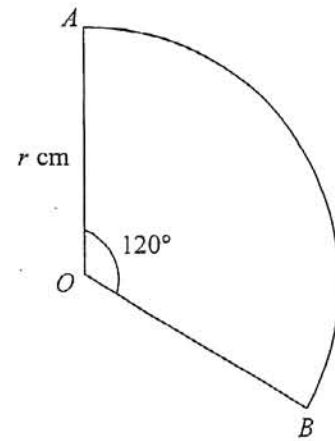


- A. -15
 B. -9
 C. 9
 D. 15

16. If the angle of elevation of P from Q is 40° , then the angle of depression of Q from P is
- A. 40° .
 - B. 50° .
 - C. 130° .
 - D. 140° .
17. The base of a solid right pyramid is a square. If the perimeter of the base is 48 cm and the length of each slant edge of the pyramid is 10 cm , then the total surface area of the pyramid is
- A. 192 cm^2 .
 - B. 336 cm^2 .
 - C. 384 cm^2 .
 - D. $96\sqrt{7}\text{ cm}^2$.
18. The base radius and the height of a right circular cylinder are 3 cm and 12 cm respectively while the base radius of a right circular cone is 6 cm . If the volume of the circular cylinder and the volume of the circular cone are the same, then the height of the circular cone is
- A. 3 cm .
 - B. 9 cm .
 - C. 18 cm .
 - D. 27 cm .
19. It is given that A , B and C are solid spheres. If the volume of B : the volume of $C = 1:8$ and the surface area of A : the surface area of $B = 9:4$, then the radius of A : the radius of $C =$
- A. $3:4$.
 - B. $3:16$.
 - C. $9:8$.
 - D. $9:32$.

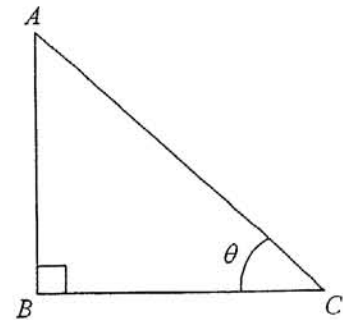
20. In the figure, OAB is a sector of radius r cm . If $\angle AOB = 120^\circ$ and the area of the sector is 12π cm² , then $r =$

- A. 3 .
- B. 4 .
- C. 6 .
- D. 18 .



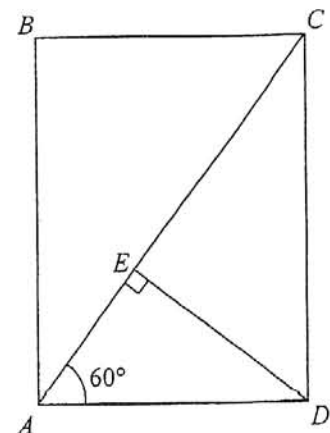
21. In the figure, $2AB = 3BC$. Find θ correct to the nearest degree.

- A. 34°
- B. 42°
- C. 48°
- D. 56°



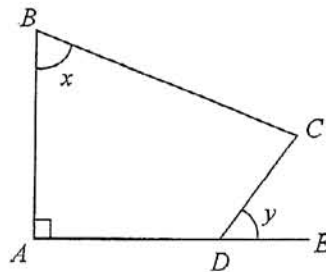
22. In the figure, $ABCD$ is a rectangle. It is given that E is the foot of the perpendicular from D to AC . If the area of $\triangle ADE$ is 1 cm² , then the area of $\triangle ABC$ is

- A. 3 cm² .
- B. 4 cm² .
- C. 5 cm² .
- D. $2\sqrt{3}$ cm² .



23. In the figure, ADE is a straight line. If $\angle ABC = x$ and $\angle CDE = y$, then $AD =$

- A. $BC \sin x - CD \sin y$.
 B. $BC \sin x - CD \cos y$.
 C. $BC \cos x - CD \sin y$.
 D. $BC \cos x - CD \cos y$.



24. If A and B are acute angles such that $A + B = 90^\circ$, then $\cos^2 A + \sin^2 B =$

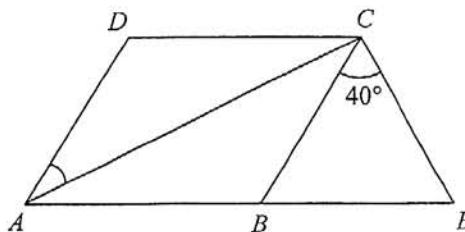
- A. 1 .
 B. $2 \sin^2 A$.
 C. $2 \cos^2 A$.
 D. $2 \cos^2 B$.

25. In $\triangle ABC$, $AB : BC : AC = 3 : 4 : 5$. Find $\tan A : \cos C$.

- A. 3:5
 B. 4:3
 C. 4:5
 D. 5:3

26. In the figure, $ABCD$ is a rhombus and ABE is a straight line. If $\angle BCE = 40^\circ$ and $BC = CE$, then $\angle CAD =$

- A. 35° .
 B. 40° .
 C. 45° .
 D. 50° .

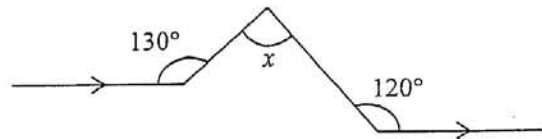


27. If each interior angle of a regular n -sided polygon is 144° , then $n =$

- A. 10.
- B. 12.
- C. 14.
- D. 16.

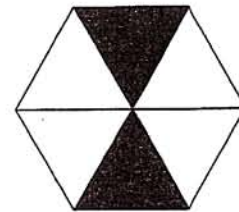
28. In the figure, $x =$

- A. 50° .
- B. 60° .
- C. 70° .
- D. 80° .



29. In the figure, the regular hexagon is divided into six equilateral triangles and two of them are shaded. The number of folds of rotational symmetry of the hexagon is

- A. 2.
- B. 3.
- C. 4.
- D. 6.



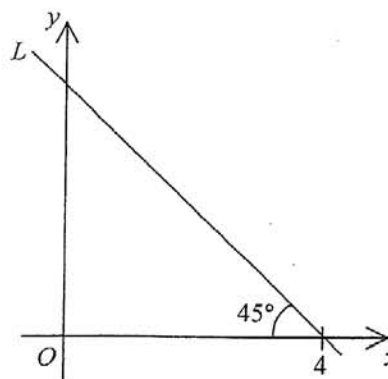
30. The coordinates of the point A are $(-3, 3)$. If A is reflected with respect to the straight line $x = 1$ to the point B , then the distance between A and B is

- A. 4.
- B. 5.
- C. 6.
- D. 8.

31. The coordinates of the points A and B are $(3, 9)$ and $(7, 1)$ respectively. If P is a point lying on the straight line $y = x + 1$ such that $AP = PB$, then the coordinates of P are
- A. $(3, 2)$.
 - B. $(3, 4)$.
 - C. $(5, 5)$.
 - D. $(5, 6)$.

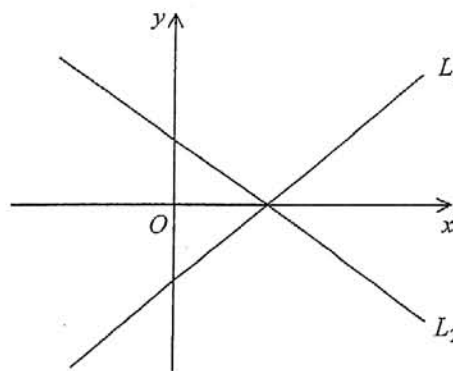
32. In the figure, the equation of the straight line L is

- A. $x + y = 4$.
- B. $x - y = 4$.
- C. $x + y = -4$.
- D. $x - y = -4$.



33. In the figure, the straight line $L_1: y = ax + b$ and the straight line $L_2: y = cx + d$ intersect at a point on the positive x -axis. Which of the following must be true?

- A. $ab > 0$
- B. $cd > 0$
- C. $ac = bd$
- D. $ad = bc$



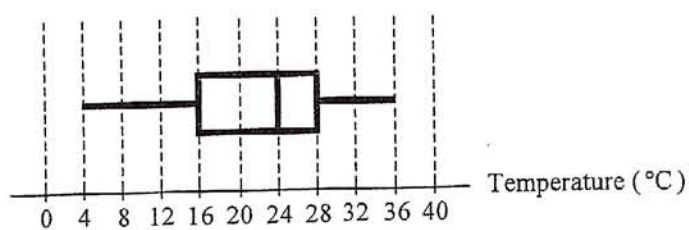
34. Peter has one \$1 coin, one \$2 coin and one \$5 coin in his pocket. If Peter takes out two coins randomly from his pocket, then the probability that he will get enough money to buy a pen of price \$3.5 is

- A. $\frac{1}{2}$.
B. $\frac{1}{3}$.
C. $\frac{2}{3}$.
D. $\frac{1}{6}$.

35. The mean height of 54 boys and 36 girls is 162 cm . If the mean height of the girls is 153 cm , then the mean height of the boys is

- A. 147 cm .
B. 157.5 cm .
C. 168 cm .
D. 175.5 cm .

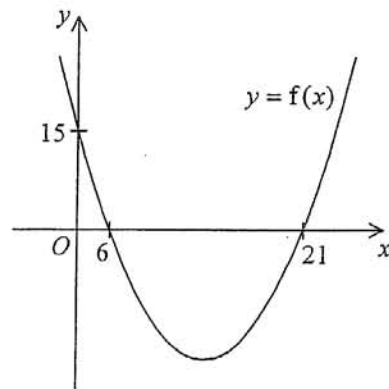
36. The box-and-whisker diagram below shows the distribution of temperatures (in °C) of water in an experiment under various settings. Which of the following are true?



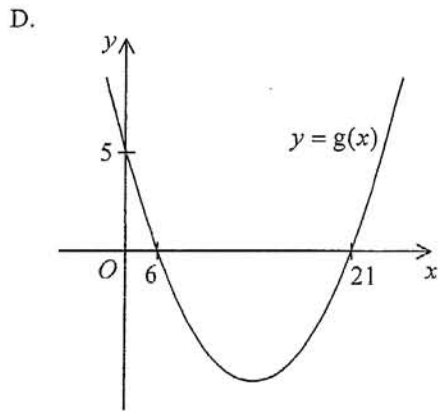
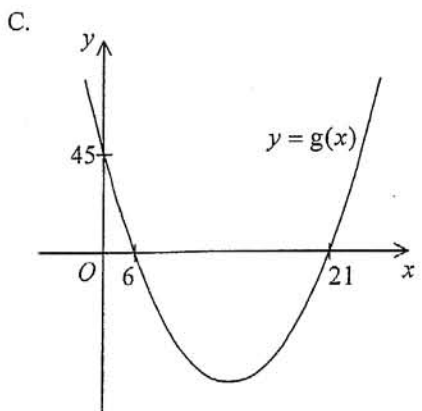
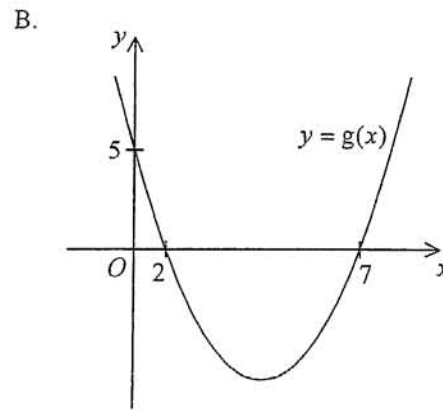
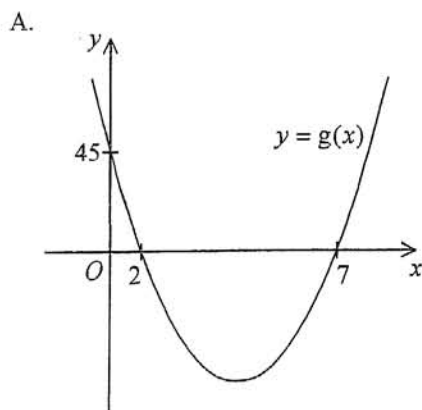
- I. The range is 40°C .
II. The median is 24°C .
III. The interquartile range is 12°C .
- A. I and II only
B. I and III only
C. II and III only
D. I, II and III

Section B

37.



The figure above shows the graph of $y = f(x)$. If $f(x) = 3g(x)$, which of the following may represent the graph of $y = g(x)$?

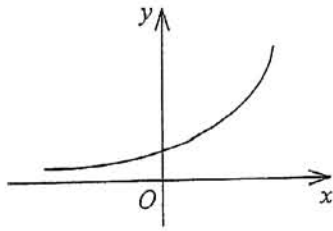


38. Which of the following is the best estimate of 1234^{3235} ?

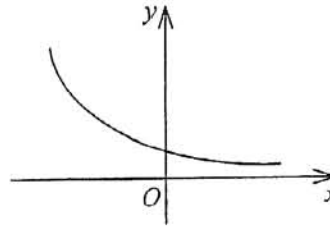
- A. 10^{4000}
- B. 10^{5000}
- C. 10^{10000}
- D. 10^{20000}

39. Which of the following may represent the graph of $y = -3^{-x}$?

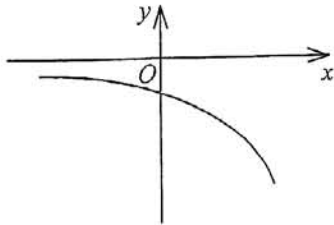
A.



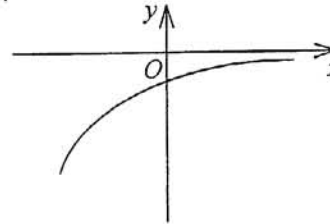
B.



C.



D.



40. Convert the decimal number $16^{12} + 14$ to a hexadecimal number.

A. $10000000000D_{16}$

B. $10000000000E_{16}$

C. $10000000000D_{16}$

D. $10000000000E_{16}$

41. When $x^{2009} + x^{2008} + x^{2007} + \dots + x$ is divided by $x+1$, the remainder is

A. -1 .

B. 0 .

C. 1 .

D. 2009 .

42. If the sum of the first n terms of a sequence is $n^2 + 2n$, then the 5th term of the sequence is

A. 9 .

B. 11 .

C. 13 .

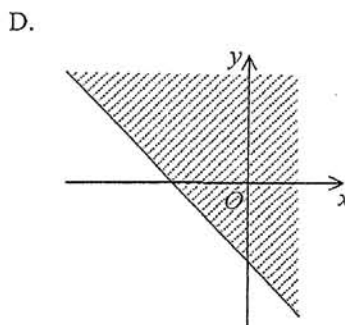
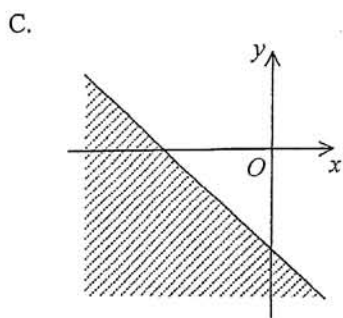
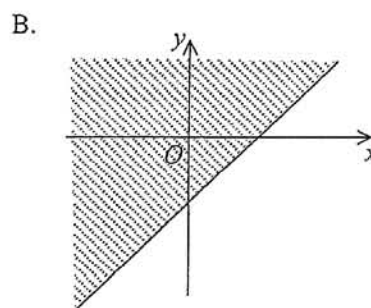
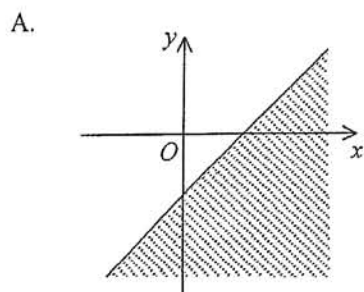
D. 35 .

43. Let a_n be the n th term of a geometric sequence. If $a_7 = 32$ and $a_9 = 8$, which of the following must be true?

- I. $a_1 > 0$
- II. $a_1 - a_2 > 0$
- III. $a_2 + a_3 + a_4 + \dots + a_{100} > 0$

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

44. Which of the following shaded regions may represent the solution of $y \leq x - 9$?

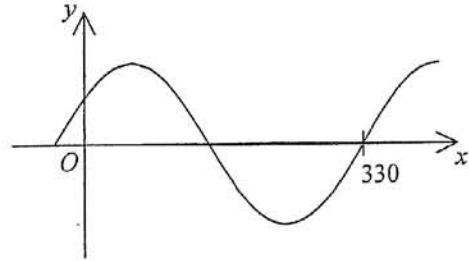


45. For $0^\circ \leq x \leq 360^\circ$, how many roots does the equation $\cos^2 x - \sin^2 x = 1$ have?

- A. 2
- B. 3
- C. 4
- D. 5

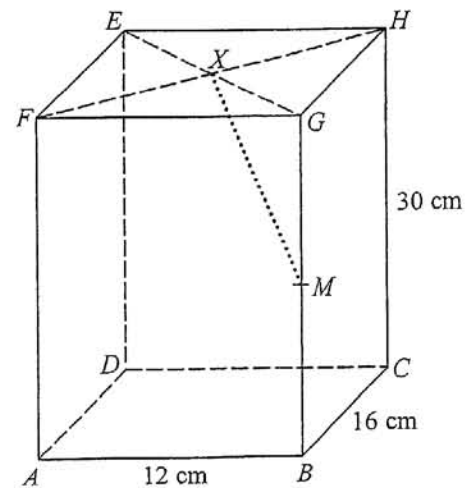
46. Let $-90^\circ < \theta < 90^\circ$. If the figure shows the graph of $y = 7\sin(x^\circ + \theta)$, then

- A. $\theta = -60^\circ$.
 B. $\theta = -30^\circ$.
 C. $\theta = 30^\circ$.
 D. $\theta = 60^\circ$.



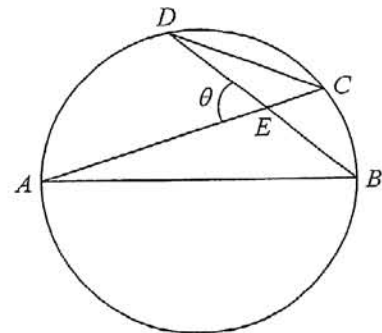
47. In the figure, $ABCDEFGH$ is a rectangular block. EG and FH intersect at X . M is the mid-point of BG . If the angle between MX and the plane $BCHG$ is θ , then $\tan \theta =$

- A. $\frac{2}{3}$.
 B. $\frac{6}{17}$.
 C. $\frac{2}{\sqrt{29}}$.
 D. $\frac{8}{\sqrt{261}}$.



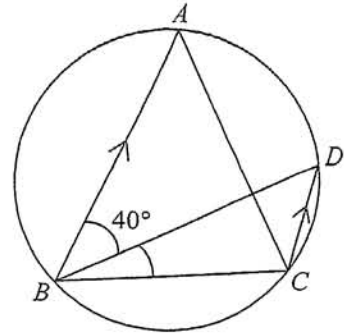
48. In the figure, AB is a diameter of the circle $ABCD$. It is given that AC and BD intersect at E . If $\angle AED = \theta$, then $\frac{CD}{AB} =$

- A. $\sin \theta$.
 B. $\cos \theta$.
 C. $\tan \theta$.
 D. $\frac{1}{\tan \theta}$.



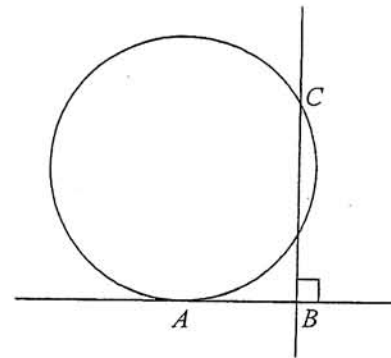
49. In the figure, $ABCD$ is a circle. If $AB = AC$, $AB \parallel DC$ and $\angle ABD = 40^\circ$, then $\angle CBD =$

- A. 10° .
- B. 20° .
- C. 30° .
- D. 40° .



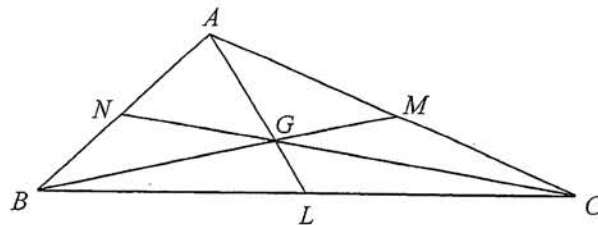
50. In the figure, AB is the tangent to the circle at A . If $AB = 20$ and $BC = 50$, find the radius of the circle.

- A. 20
- B. 25
- C. 29
- D. 30



51. In the figure, G is the centroid of $\triangle ABC$. AG , BG and CG are produced to meet BC , AC and AB at L , M and N respectively. If $BL = 13$ cm, $BN = 5$ cm and $CM = 12$ cm, find the area of $\triangle ABC$.

- A. 60 cm^2
- B. 120 cm^2
- C. 180 cm^2
- D. 240 cm^2

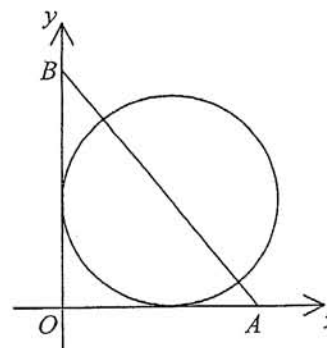


52. The coordinates of two vertices of a triangle are $(-4, -8)$ and $(6, 2)$. If the coordinates of the circumcentre of the triangle are $(k, -4)$, then $k =$

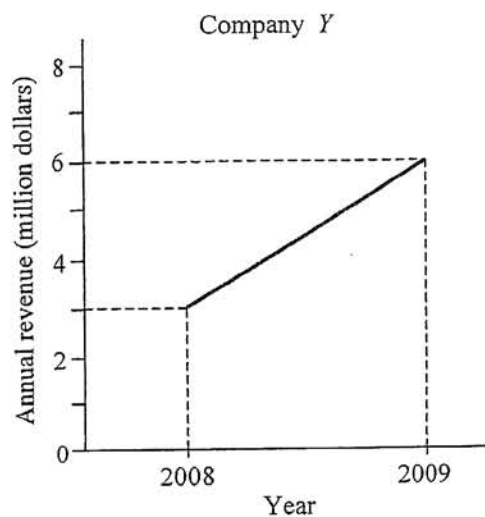
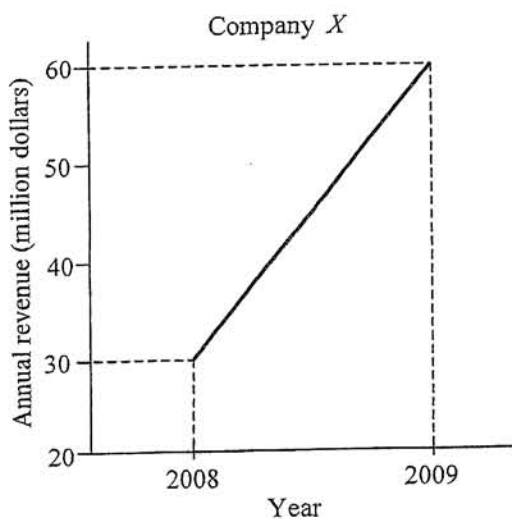
- A. -1 .
- B. 0 .
- C. 1 .
- D. 2 .

53. In the figure, the circle touches the positive x -axis and the positive y -axis. The coordinates of the points A and B are $(21, 0)$ and $(0, 28)$ respectively. If AB passes through the centre of the circle, find the equation of the circle.

- A. $x^2 + y^2 - 12x - 12y + 36 = 0$
 B. $x^2 + y^2 - 21x - 28y + 196 = 0$
 C. $x^2 + y^2 - 24x - 24y + 144 = 0$
 D. $x^2 + y^2 - 42x - 56y + 441 = 0$



54. The broken line graphs below show the annual revenue (in million dollars) of Company X and Company Y in 2008 and 2009.



Which of the following statements about the percentage increases of the annual revenue of the two companies from 2008 to 2009 is true?

- A. The percentage increases of the annual revenue of company X and company Y are the same.
 B. The percentage increase of the annual revenue of company X is twice that of company Y .
 C. The percentage increase of the annual revenue of company X is five times that of company Y .
 D. The percentage increase of the annual revenue of company X is ten times that of company Y .

END OF PAPER