MOCK EXAM 4

MATHEMATICS Compulsory Part

PAPER 2

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

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet.

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. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

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.

There are 30 questions in Section A and 15 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. $(-3n^2)^{-4} =$

   A. $-\frac{1}{12n^2}$.

   B. $\frac{1}{12n^{16}}$.

   C. $\frac{1}{81n^8}$.

   D. $-\frac{1}{81n^8}$.

2. If $\frac{a}{2x}+\frac{b}{3y}=1$, then $y =$

   A. $\frac{2ax}{3(2x-a)}$.

   B. $\frac{2ax}{3(a-2x)}$.

   C. $\frac{2bx}{3(2x-a)}$.

   D. $\frac{2bx}{3(a-2x)}$.

3. $x^2(x-1)-x+1 =$

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

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

   C. $x^2(x-1)^2$.

   D. x^3+1.

4. Let $f(x) = 3x^3 + kx^2 - 4x - 2$, where k is a constant. If $f(x)$ is divisible by $3x + 1$, find the remainder when $f(x)$ is divided by $x + 1$.

   A. 6

   B. 7

   C. 26

   D. 29

5. If k is a constant such that the quadratic equation $x^2 + kx + 3k + 16 = 0$ has equal roots, then k =

   A. –4 or 16.

   B. –8 or 2.

   C. –8.

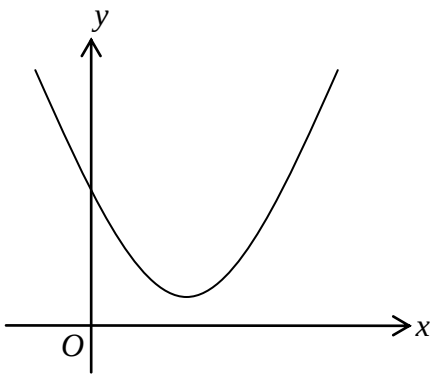
   D. 8.

6. The figure shows the graph of $y = ax^2 + 2x + b$, where a and b are constants. Which of the following is/are true?

   I. $a > 0$

   II. $b < 0$

   III. $ab < 1$



   A. I only

   B. II only

   C. I and III only

   D. II and III only

7. The solution of $2x - 18 > 0$ and $13 < 2x - 3 < 21$ is

   A. $x > 8$.

   B. $x > 9$.

   C. $8 < x < 12$.

   D. $9 < x < 12$.

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8. The price of 3 digital cameras and 2 mobile phones is \$15 300. If the price of 4 digital cameras and the price of 3 mobile phones are the same, then the price of a mobile phone is

   A. \$2 550.
   B. \$2 700.
   C. \$3 400.
   D. \$3 600.

9. When *A* sells a product to *B*, *A* makes a profit of 25%. When *B* sells it to *C*, *B* makes a profit of 30%. If *B* makes a profit of \$600, find the profit made by *A*.

   A. \$350
   B. \$400
   C. \$450
   D. \$500

10. If the surface area of a sphere is increased by 21%, then its volume is increased by

    A. 31.5%.
    B. 33.1%.
    C. 42%.
    D. 72.8%.

11. If α and β are non-zero numbers such that $\frac{3\alpha+2\beta}{\alpha+4\beta} = 2$, then $\frac{3\alpha+9\beta}{4\alpha+6\beta} =$

    A. $\frac{3}{2}$.
    B. 1.
    C. $\frac{9}{10}$.
    D. $\frac{3}{4}$.

12. If $1.04556 < x < 1.04568$, which of the following is true?

    A. $x = 1.04$ (correct to 3 significant figures)

    B. $x = 1.04$ (correct to 3 decimal places)

    C. $x = 1.046$ (correct to 4 significant figures)

    D. $x = 1.046$ (correct to 4 decimal places)

13. It is given that z varies directly as the square of x and inversely as the square root of y. If x is increased by 20% and y is decreased by 36%, then z is

    A. increased by 56%.

    B. decreased by 56%.

    C. increased by 80%.

    D. decreased by 80%.

14. A truck travels at an average speed of 65 km/h for 22 minutes and then it travels at an average speed of 45 km/h for 33 minutes. The average speed of the truck for the whole journey is

    A. 53 km/h.

    B. 55 km/h.

    C. 57 km/h.

    D. 59 km/h.

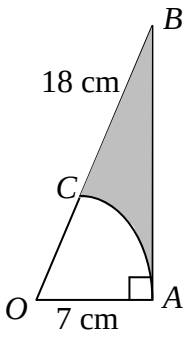
15. In the figure, OAC is a sector of radius 7 cm. OAB is a right-angled triangle and BC = 18 cm. Find the area of the shaded region.

    A. 153.9 cm^2

    B. 84 cm^2

    C. 52.5 cm^2

    D. 31.5 cm^2



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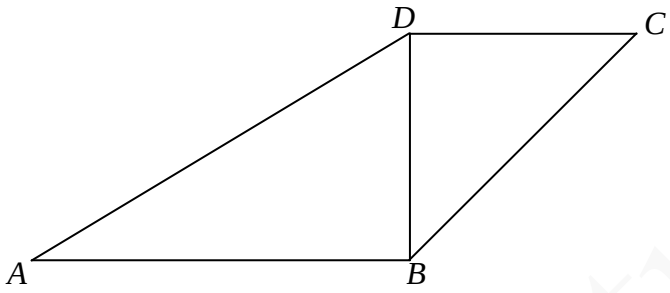
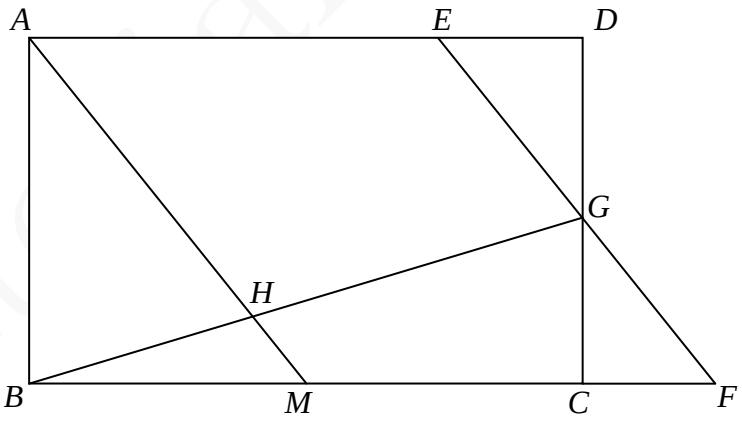
16. In the figure, $ABCD$ is a quadrilateral such that AB // CD and $\angle ABD = 90^o$. If $CD = 40$, $BC = 50$ and $AD = 78$, find the area of quadrilateral $ABCD$.

A. $1680\ cm^2$.
B. $1920\ cm^2$.
C. $1950\ cm^2$.
D. $3360\ cm^2$.



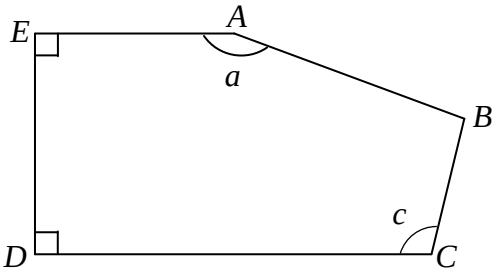
17. In the figure, $ABCD$ is a rectangle. Let M be the mid-point of BC. E is a point lying on AD. F is a point lying on BC produced such that EF // AM. CD and EF intersect at the point G while AM and BG intersect at the point H. G is the mid-point of CD. If the area of $\triangle BMH$ is $12\ cm^2$, then the area of the trapezium $AEGH$ is

A. $36\ cm^2$.
B. $99\ cm^2$.
C. $117\ cm^2$.
D. $135\ cm^2$.



18. In the figure, DE =

A. $AB \cos a + BC \cos c$.
B. $AB \cos a + BC \sin c$.
C. $AB \sin a + BC \cos c$.
D. $AB \sin a + BC \sin c$.



19. $[\sin(270^\circ + \theta) + 1][\cos(360^\circ - \theta) + 1] =$

A. $\sin^2\theta$.

B. $\cos^2\theta$.

C. $-\sin^2\theta$.

D. $-\cos^2\theta$.

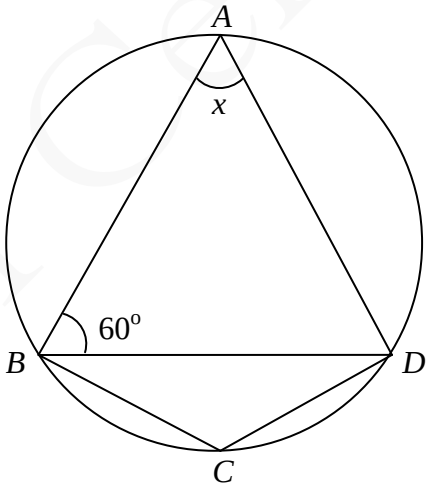
20. In the figure, $\overset{\frown}{BC} : \overset{\frown}{CD} : \overset{\frown}{DA} = 3 : 3 : 4$. If $\angle ABD = 60^\circ$, find x.

A. 30°

B. 45°

C. 60°

D. 90°



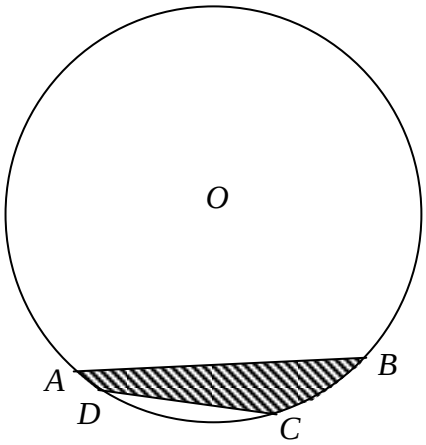
21. In the figure, O is the centre of the circle $ABCD$. If $OA = CD = 6$ cm and $\angle AOB = 90^\circ$, then the area of the shaded region is

A. $\left(3\pi + 18 - 9\sqrt{3}\right)$ cm^2.

B. $\left(3\pi - 18 + 9\sqrt{3}\right)$ cm^2.

C. $\left(3\pi + 9\right)$ cm^2.

D. $\left(3\pi - 9\right)$ cm^2.



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22. If an interior angle of a regular n-sided polygon is 3 times an exterior angle of the polygon, which of the following are true?

I. The value of n is 9.

II. Each exterior angle of the polygon is 45^{o}.

III. The number of axes of reflectional symmetry of the polygon is 8.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

24. The coordinates of the point A are $(-3, 6)$. A is rotated clockwise about the origin through 90^{o} to the point B. B is then reflected with respect to the straight line $y = -1$ to the point C. Find the y-coordinate of C.

A. -5

B. -3

C. 1

D. 4

.

24. The coordinates of the points A and B are $(5, 8)$ and $(7, 12)$ respectively. Let P be a moving point in the rectangular coordinate plane such that $AP = AB$. Find the equation of the locus of P.

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

B. $x + 2y - 26 = 0$

C. $x^2 + y^2 - 10x - 16y + 69 = 0$

D. $x^2 + y^2 - 14x - 24y + 173 = 0$

25. The figure shows the straight line L: $x + by + c = 0$. Which of the following are true?

I. $b > 0$

II. $c > 0$

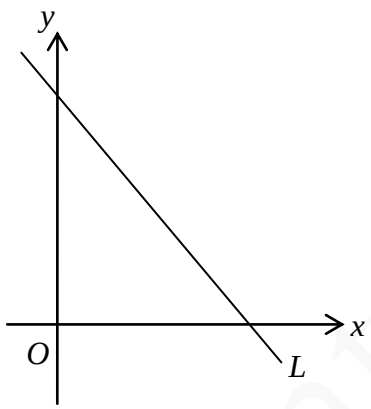
III. $bc < 0$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



26. If the radius of the circle $x^2 + y^2 + 4kx - 20y - 59k = 0$ is 20, then $k =$

A. 4.

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

C. $\frac{15}{2}$ or -10.

D. 4 or $-\frac{75}{4}$.

27. Two numbers are randomly drawn at the same time from five cards numbered 1, 2, 3, 4, and 5. Find the probability that the sum of the numbers drawn is a prime number.

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

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

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

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

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28. The mean weight of 40 teachers and 160 students is 57 kg. If the mean weight of the teachers is 65 kg, then the mean weight of the students is

    A. 56 kg.
    B. 55 kg.
    C. 54.5 kg.
    D. 53 kg.

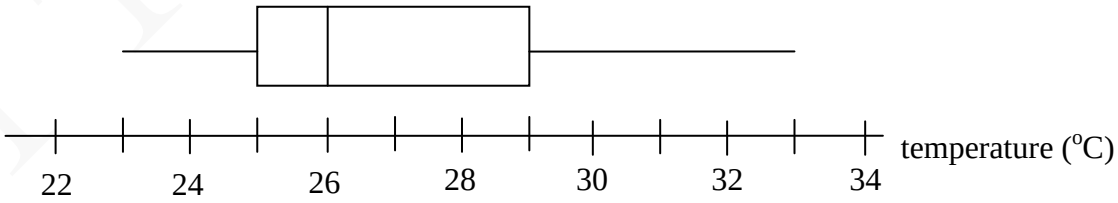
29. The stem-and-leaf diagram below shows the distribution of the number of English books owned by a class of students.

Stem (tens)	Leaf (units)
0	6 6 7 8 9
1	0 1 2 2 3 4 5 5 8
2	0 1 1 2 2 3 8
3	0 2 2 3

    A student is randomly selected from the class. Find the probability that the selected student has no more than 22 books.

    A. 0.24
    B. 0.32
    C. 0.68
    D. 0.76

30. The box-and-whisker diagram drawn below shows the distribution of the temperatures in a month. Which of the following is/are true?



    I. The inter-quartile range is 4 °C.
    II. The temperature of the coolest day is 23 °C.
    III. More than half of the days have the temperature higher than 28 °C.

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

Section B

31. The L.C.M. of $8a^3b^5$, $20a^2b$, $36b^6$ is

    A. $4b$.

    B. $4a^2b$.

    C. $360a^3b^6$.

    D. $360a^5b^{12}$.

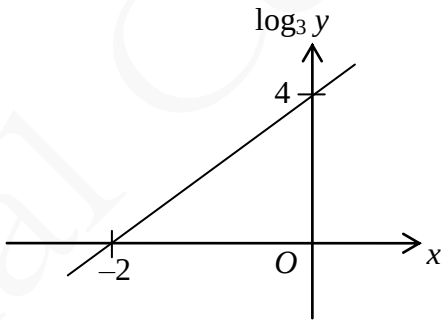
32. The graph in the figure shows the linear relation between x and $\log_3 y$. If $y = ab^x$, then a =

    A. 2.

    B. 4.

    C. 9.

    D. 81



33. $12 \times 16^{12} + 14 \times 16^2 + 15 =$

    A. $C000000000DE_{16}$

    B. $C000000000EF_{16}$

    C. $C000000000D0E_{16}$

    D. $C000000000E0F_{16}$

34. Let f(x) be a quadratic function. If the coordinates of the vertex of the graph of y = f(x) are $(-3, 6)$, which of the following must be true?

    A. The roots of the equation f(x) = 0 are nonreal numbers.

    B. The roots of the equation f(x) + 3 = 0 are real numbers.

    C. The roots of the equation f(x) + 6 = 0 are real numbers.

    D. The roots of the equation f(x) − 6 = 0 are real numbers.

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35. Let $u = \dfrac{2}{a-i}$ and $v = \dfrac{2}{-a-i}$, where a is a real number. Which of the following must be true?

I. The real part of u is equal to the real part of v.

II. The imaginary part of $\dfrac{1}{u}$ is equal to the imaginary part of $\dfrac{1}{v}$.

III. $uv > 0$.

A. I only

B. II only

C. I and III only

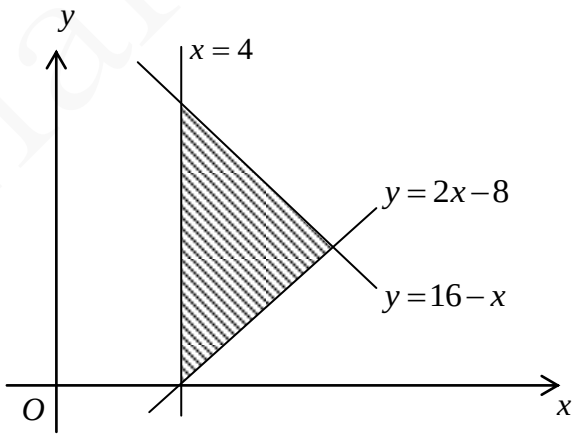
D. II and III only

36. The figure shows a shaded region. If (h, k) is a point lying in the shaded region, which of the following are true?

I. $h \geq 4$

II. $2h - k \leq 8$

III. $h + k \geq 16$



A. I and II only

B. I and III only

C. II and III only

D. I, II and III

37. Let a_n be the nth term of an arithmetic sequence. If $a_{16} = 27$ and $a_{28} = -21$, which of the following are true?

I. $a_2 - a_1 < 0$

II. $a_{21} > 0$

III. $a_{12} + a_{13} + a_{14} + \Lambda + a_{33} > 0$

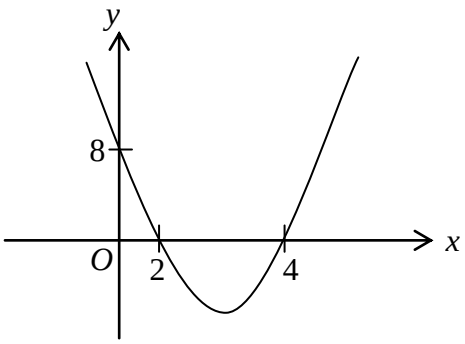
A. I and II only

B. I and III only

C. II and III only

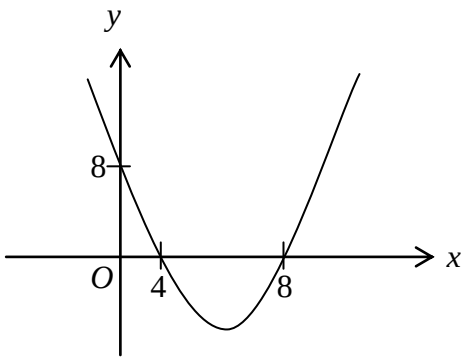
D. I, II and III

38.

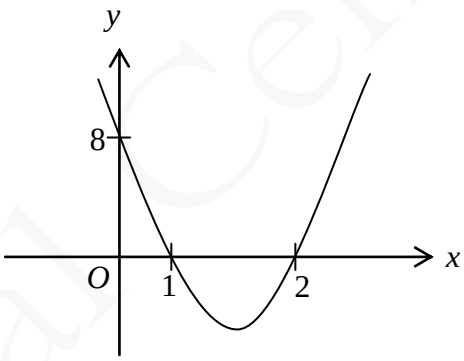


The figure above shows the graph of $y = f(x)$. If $g(x) = f(2x)$, which of the following may represent the graph of $y = g(x)$?

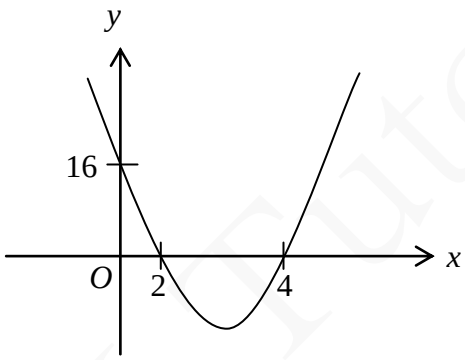
A.



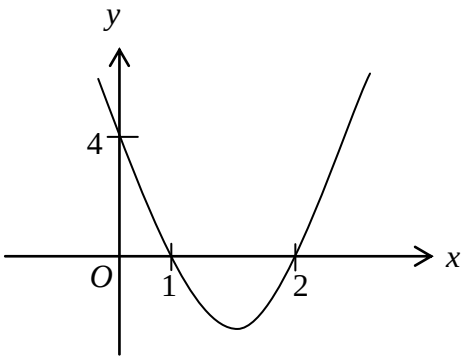
B.



C.



D.



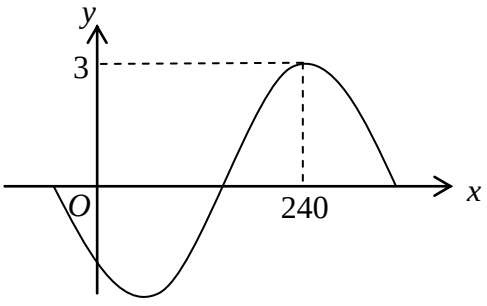
39. Let k be a constant and $-90^\circ < \theta < 90^\circ$. If the figure shows the graph of $y = k\cos(x^\circ + \theta)$, then

A. $k = 3$, $\theta = 60^\circ$.

B. $k = 3$, $\theta = -60^\circ$.

C. $k = -3$, $\theta = 60^\circ$.

D. $k = -3$, $\theta = -60^\circ$.



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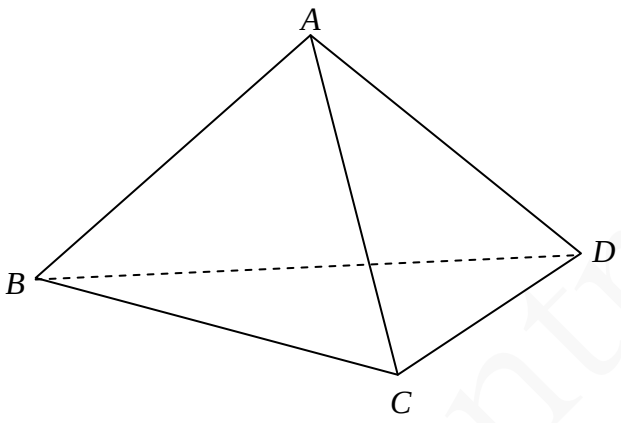
40. The figure shows a regular tetrahedron $ABCD$. If the angle between AB and the plane BCD is θ, then $\cos\theta =$

A. $\frac{\sqrt{3}}{3}$

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

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

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



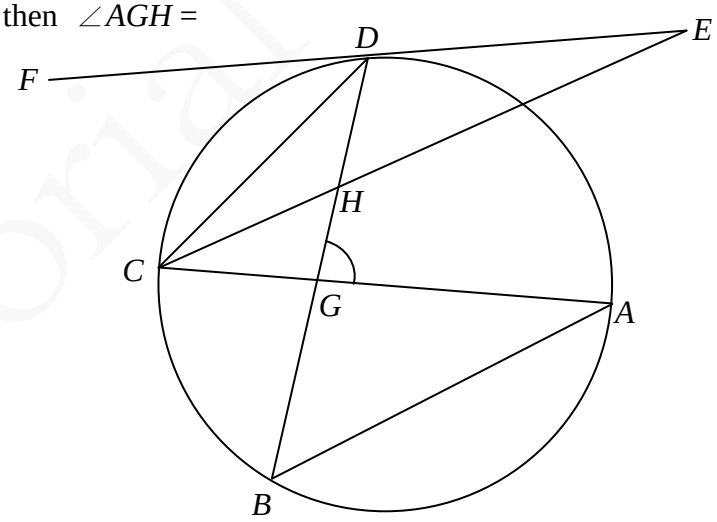
41. In the figure, AC is a diameter of the circle $ABCD$. EF is a tangent to the circle at D such that AB // EC. point A. Denote the point of intersection of AC and DB by G and the point of intersection of CE and DB by H. If $\angle CDF = 44^o$ and $\angle CED = 25^o$, then $\angle AGH =$

A. 44^o.

B. 46^o.

C. 57^o.

D. 73^o



42. If the straight line $x - ky - 1 = 0$ does not intersect with the circle $x^2 + y^2 + 2ky + 2 = 0$, find the range of values of k.

A. $-\sqrt{3} < k < \sqrt{3}$

B. $k < -\sqrt{3}$ or $k > \sqrt{3}$

C. $k = -\sqrt{3}$ or $\sqrt{3}$

D. $k > \sqrt{3}$

43. There are 15 girls and 12 boys in a singing club. If a team of 3 boys and 5 girls is selected from the club to participate in a singing contest, how many different teams can be formed?

    A. 360 360
    B. 660 660
    C. 2 220 075
    D. 475 675 200

44. In a Mathematics test, John gets 81 marks and his standard score is 2 while Sue gets 60 marks and her standard score is –1.5. Find the standard deviation of the test scores.

    A. 4.5 marks
    B. 6 marks
    C. 8 marks
    D. 69 marks

45. Two sets of numbers are given: $\{x - 4, x - 2, x, x + 2, x + 4\}$ and $\{y - 4, y - 2, y, y + 2, y + 4\}$ where $x > y$. μ_1 and μ_2 are their means respectively and σ_1 and σ_2 are their standard deviations respectively. Which of the following must be true?

    I. $\mu_1 = \mu_2$
    II. $\sigma_1 = \sigma_2$
    III. $\mu_1 > \mu_2$
    IV. $\sigma_1 > \sigma_2$

    A. I and II
    B. II and III
    C. I and IV
    D. III and IV

END OF PAPER

