HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2024

MATHEMATICS Compulsory Part
PAPER 2

11:30 am – 12:45 pm (1¼ hours)

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.

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.

Not to be taken away before the end of the examination session

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

   A. $2x^2$.

   B. $6xy$.

   C. $12xy$.

   D. $2x^2+18y^2$.

2. $\dfrac{(2\alpha)^3}{(4\alpha^{-5})^{-1}} =$

   A. $2\alpha^8$.

   B. $32\alpha^8$.

   C. $\dfrac{2}{\alpha^2}$.

   D. $\dfrac{32}{\alpha^2}$.

3. If $k=\dfrac{5}{2m}+n$, then $m =$

   A. $\dfrac{5}{2(k-n)}$.

   B. $\dfrac{5}{2(n-k)}$.

   C. $\dfrac{2(k-n)}{5}$.

   D. $\dfrac{2(n-k)}{5}$.

4. $\sqrt{333} =$

A. 18 (correct to the nearest integer).

B. 18.24 (correct to 2 decimal places).

C. 18.248 (correct to 3 significant figures).

D. 18.2482 (correct to 4 decimal places).

5. The price of 2 apples and 3 lemons is \$38 . If the price of 3 apples and 2 lemons is \$47 , then the price of 4 apples and 7 lemons is

A. \$78 .

B. \$80 .

C. \$82 .

D. \$84 .

6. If a , b and c are non-zero constants such that $4x^2+2ax+3a \equiv x(4x+b)+2c$, then $a:b:c =$

A. $2:4:3$.

B. $3:4:2$.

C. $4:6:3$.

D. $6:4:3$.

7. Let m be a constant. Solve the equation $x^2-3x=(m-1)^2-3(m-1)$.

A. $x=m-1$ or $x=m-4$

B. $x=m-1$ or $x=4-m$

C. $x=1-m$ or $x=m-4$

D. $x=1-m$ or $x=4-m$

Go on to the next page

8. Let $g(x)=(x+1)(x+a)$, where a is a constant. If $g(1)=g(2)$, then $g(a)=$

A. -4 .

B. 0 .

C. 12 .

D. 24 .

9. Let $f(x)=x^3+kx^2+5x+10$, where k is a constant. If $f(x)$ is divisible by $x+k$, find the remainder when $f(x)$ is divided by $x+1$.

A. -2

B. 2

C. 6

D. 18

10. The solution of $\frac{1-x}{2}\geq 4$ or $7+5x\leq -3$ is

A. $x\leq -7$.

B. $x\leq -2$.

C. $-7\leq x\leq -2$.

D. $x\leq -7$ or $x\geq -2$.

11. In a school, 40% of the students are girls and $\beta\%$ of the girls are foreign students. It is given that 30% of the boys in the school are foreign students. In the school, the number of foreign students and the number of girls are equal. Find β .

A. 20

B. 45

C. 55

D. 80

12. A car travels at an average speed of 60 km/h for 18 minutes and then the car travels at an average speed of 40 km/h for 27 minutes. The average speed of the car for the whole journey is

A. 48 km/h .

B. 50 km/h .

C. 52 km/h .

D. 54 km/h .

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

A. is increased by 20% .

B. is decreased by 20% .

C. is increased by 80% .

D. is decreased by 80% .

14. Which of the following statements about the graph of $y = 2(6-x)^2 - 7$ is true?

A. The graph opens upwards.

B. The graph does not cut the x-axis.

C. The y-intercept of the graph is -7 .

D. The graph passes through the point $(-6, -7)$.

15. If the arc length and the area of a sector are 8π cm and 80π cm^2 respectively, then the angle of the sector is

A. $36°$.

B. $45°$.

C. $60°$.

D. $72°$.

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16. The ratio of the height of a right circular cylinder to the height of a right circular cone is $32:15$ while the ratio of the volume of the circular cylinder to the volume of the circular cone is $10:9$. If the base radius of the circular cylinder is 25 cm, then the base radius of the circular cone is

A. 20 cm.

B. 24 cm.

C. 48 cm.

D. 60 cm.

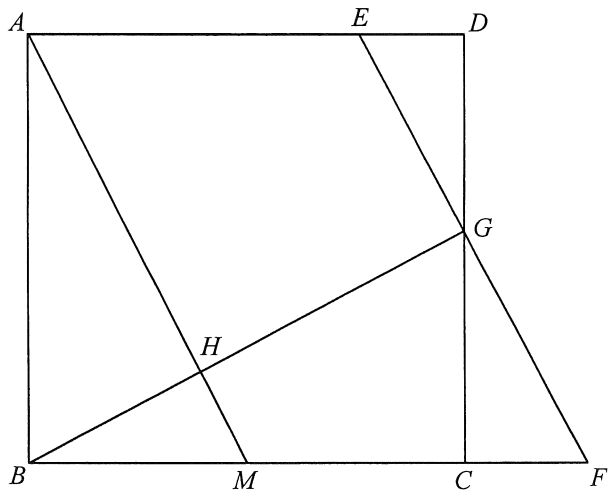
17. In the figure, $ABCD$ is a square. Let M be the mid-point of BC. E is a point lying on AD such that $AE:ED=3:1$. F is a point lying on BC produced such that $EF//AM$. CD and EF intersect at the point G while AM and BG intersect at the point H. If the area of ΔBMH is $4\,\text{cm}^2$, then the area of the trapezium $AEGH$ is

A. $12\,\text{cm}^2$.

B. $33\,\text{cm}^2$.

C. $39\,\text{cm}^2$.

D. $45\,\text{cm}^2$.



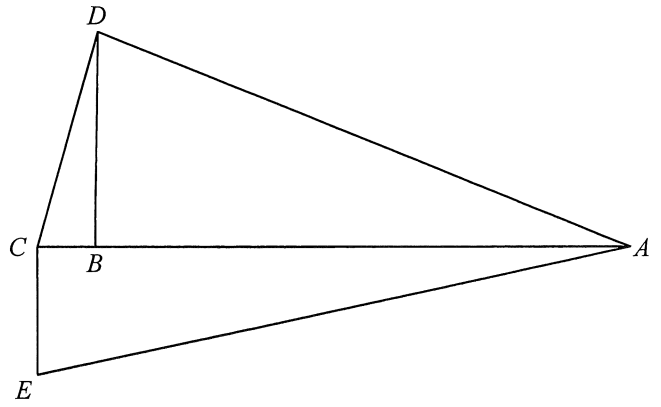
18. In the figure, ABC is a straight line. It is given that $AD=37$ cm, $BC=5$ cm, $BD=12$ cm, $CD=13$ cm and $CE=9$ cm. If $\angle ACE=90°$, find the perimeter of the quadrilateral $ADCE$.

A. 76 cm

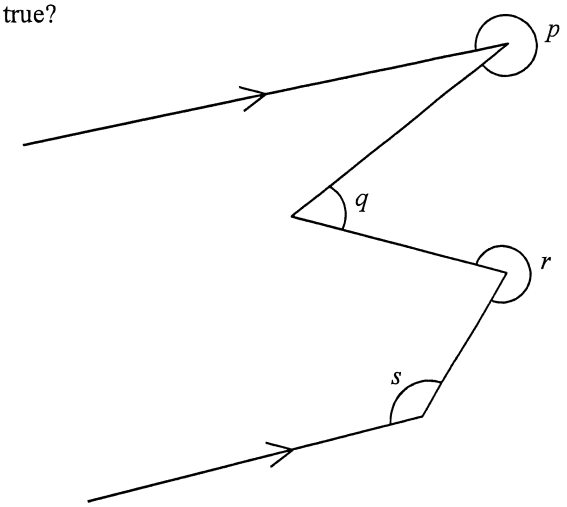
B. 90 cm

C. 100 cm

D. 180 cm



19. According to the figure, which of the following must be true?



A. $p+q-r=90°$

B. $p-r+s=180°$

C. $p+q-r+s=270°$

D. $p+q+r-s=540°$

20. If the sum of the interior angles of a regular polygon is $900°$, which of the following is/are true?

I. The number of diagonals of the polygon is 7.
II. The number of folds of rotational symmetry of the polygon is 7.
III. The number of axes of reflectional symmetry of the polygon is 7.

A. I only

B. II only

C. I and III only

D. II and III only

21. In the figure, $ABCD$ is a rhombus. Denote the point of intersection of AC and BD by E. Let F be a point such that $BH // EF$ and $CFHG$ is a rectangle, where G and H are points lying on AC produced and BC produced respectively. Denote the point of intersection of CD and EF by I. Which of the following must be true?

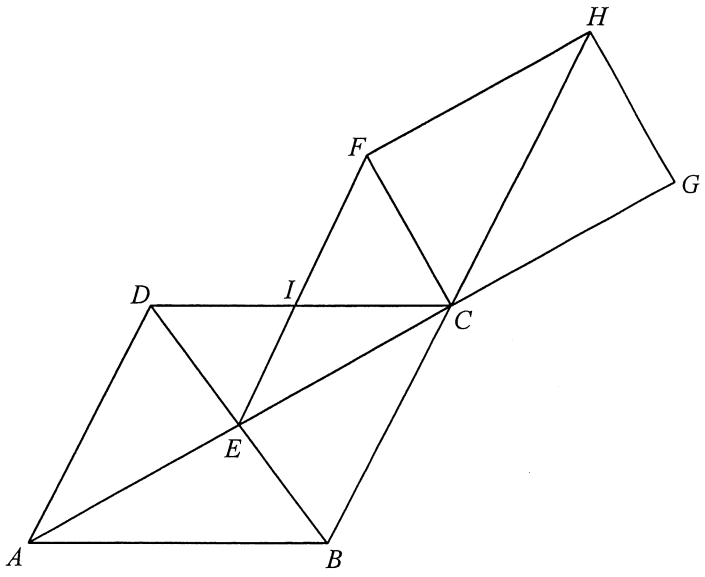
I. $CI = FI$
II. $\angle ABE = \angle GCH$
III. $\Delta ADE \cong \Delta HCF$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



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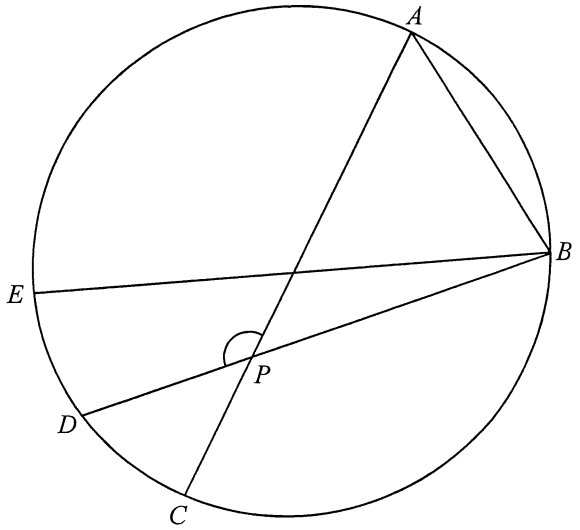
22. In the figure, $ABCDE$ is a circle. AC and BE are diameters of the circle. Let P be the point of intersection of AC and BD. If $\angle ABE = 46°$ and $\angle DBE = 16°$, then $\angle APD =$

A. $104°$.

B. $108°$.

C. $120°$.

D. $135°$.



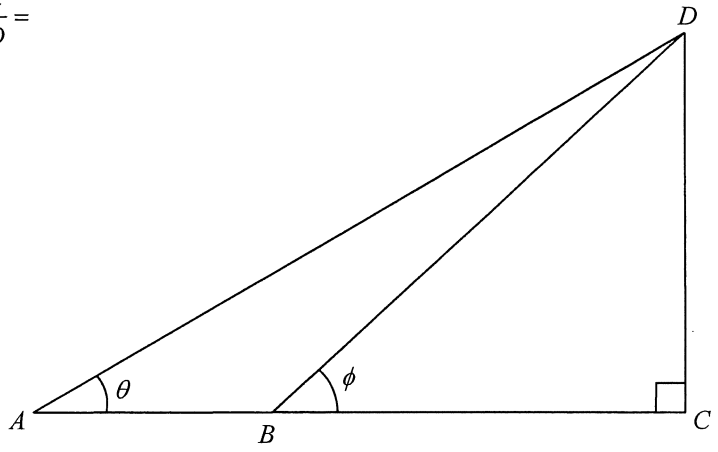
23. In the figure, ABC is a straight line. $\dfrac{BC}{AD} =$

A. $\dfrac{\sin\theta}{\tan\phi}$.

B. $\dfrac{\tan\phi}{\sin\theta}$.

C. $\dfrac{\cos\theta}{\tan\phi}$.

D. $\dfrac{\tan\phi}{\cos\theta}$.



24. The coordinates of the point U are $(-3, -8)$. U is rotated anticlockwise about the origin through $90°$ to the point V. V is then reflected with respect to the straight line $x = 2$ to the point W. Find the x-coordinate of W.

A. -4

B. -3

C. 7

D. 12

25. The coordinates of the points A and B are $(-3, 1)$ and $(-7, -5)$ respectively. If P is a point lying on the straight line $x - y + 13 = 0$ such that $AP = PB$, then the y-coordinate of P is

A. -11.

B. -2.

C. 2.

D. 11.

26. Find the constant k such that the straight lines $6x - 8y = 7k$ and $kx + 12y = 5$ do not intersect with each other.

A. -16

B. -9

C. 9

D. 16

27. Denote the circle $3x^2 + 3y^2 - 6x + 12y - 4 = 0$ by C. Which of the following are true?

I. The origin lies inside C.
II. The circumference of C is less than 16.
III. The perpendicular distance from the centre of C to the x-axis is 2.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Go on to the next page

28. Two numbers are randomly drawn at the same time from six cards numbered 1, 2, 3, 4, 5 and 6 respectively. Find the probability that the product of the numbers drawn is not less than 12.

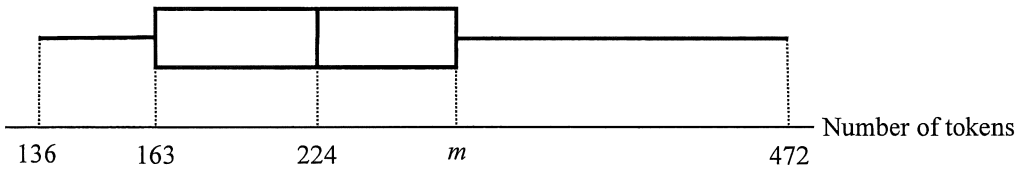
A. $\frac{1}{3}$

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

C. $\frac{7}{15}$

D. $\frac{8}{15}$

29. The box-and-whisker diagram below shows the distribution of the numbers of tokens got by a group of children in a game. If the range of the distribution is the triple of its inter-quartile range, find m.



A. 248

B. 275

C. 336

D. 360

30. Consider the following positive integers:

$$5 \quad 5 \quad 5 \quad 6 \quad 9 \quad 9 \quad 11 \quad 13 \quad m \quad n$$

Let p, q and r be the standard deviation, the mode and the median of the above positive integers respectively. If the mean of the above positive integers is 7, which of the following must be true?

I. $p > 3$
II. $q = 5$
III. $r < 7$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Section B

31. The H.C.F. of u^2v^3w, u^3vw^2 and $u^2v^3w^4$ is

A. uvw.

B. u^2vw.

C. $u^2v^3w^4$.

D. $u^3v^3w^4$.

32. $AF000000000BC_{16}$ =

A. $175\times16^{11}+188$.

B. $192\times16^{11}+205$.

C. $175\times16^{12}+188$.

D. $192\times16^{12}+205$.

33. If $x=\log_2 y-2$ and $(\log_2 y)^2=5\log_2 y+x-7$, then $y=$

A. 1.

B. 8.

C. 1 or 3.

D. 3 or 8.

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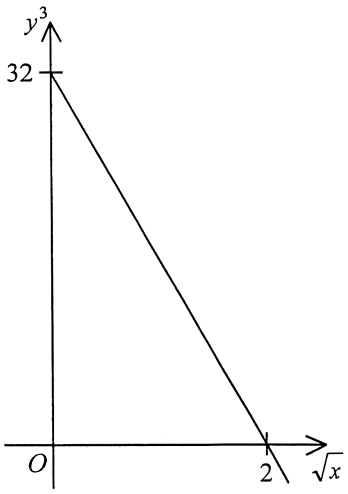
34. The graph in the figure shows the linear relation between y^3 and $\sqrt{x}$. If $x = 36$, then $y =$



A. -64.

B. -16.

C. -8.

D. -4.

35. Let $z = (a-5)i + \dfrac{(a+2)i}{2+i}$. If a and z are real numbers, then $a - z =$

A. 2.

B. 3.

C. 4.

D. 5.

36. The sum of the first n terms of a sequence is $n(2n+3)$. Which of the following are true?

I. 14 is a term of the sequence.
II. The nth term of the sequence is $4n+1$.
III. The sequence is an arithmetic sequence.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

37. Consider the following system of inequalities:

$$\begin{cases} x-2y \le 1 \\ x+4y \le 13 \\ 2x-y \ge -1 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. Find the constant c such that the least value of $5x-2y+c$ is 22, where (x, y) is a point lying in R.

A. 1

B. 23

C. 25

D. 29

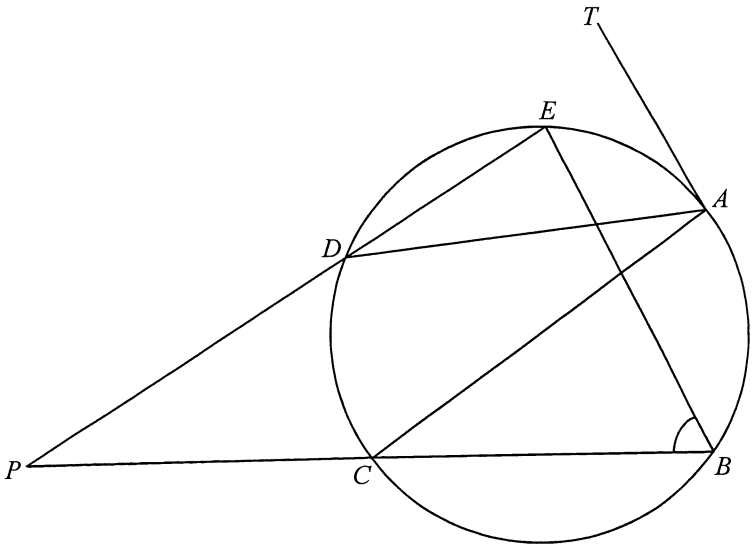
38. In the figure, TA is the tangent to the circle $ABCDE$ at the point A. BC produced and ED produced meet at the point P. If $\angle ACB = 43°$, $\angle DAT = 55°$ and $\angle CPD = 29°$, then $\angle CBE =$

A. $64°$.

B. $69°$.

C. $72°$.

D. $78°$.



39. For $0° < \theta \le 360°$, how many roots does the equation $4\cos^2\theta - 3\cos\theta - 1 = 0$ have?

A. 3

B. 4

C. 5

D. 6

Go on to the next page

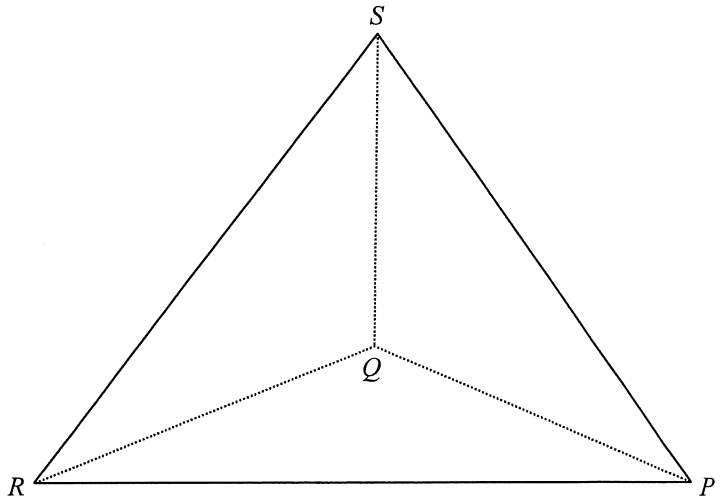
40. In the figure, the base PQR of the tetrahedron $PQRS$ lies on the horizontal ground. It is given that Q is vertically below S. If $\angle PQR = 90°$, $\angle QPS = 30°$ and $\angle QRS = 45°$, then $\cos\angle PRS =$

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

B. $\frac{3}{4}$.

C. $\frac{\sqrt{2}}{4}$.

D. $\frac{\sqrt{3}}{6}$.



41. Let G, H, I and J be the centroid, the orthocentre, the in-centre and the circumcentre of ΔPQR respectively. If $\angle PQR = \angle PRQ = 22°$, which of the following are true?

I. G lies inside ΔPQR.
II. H lies outside ΔPQR.
III. I, J and Q are collinear.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

42. A queue is formed by 2 managers and 7 officers. If no managers are next to each other, how many different queues can be formed?

A. 80 640

B. 141 120

C. 282 240

D. 362 880

43. There are three questions in a test. The probabilities that a student answers the first question correctly, the second question correctly and the third question correctly are 0.6, 0.7 and 0.8 respectively. Find the probability that the student answers at least 1 question correctly in this test.

A. 0.024

B. 0.188

C. 0.812

D. 0.976

44. In an examination, the scores (in marks) of the candidates are as follows:

39 10 13 16 17 19 25 26 28 30 30 32

Which of the following is/are true?

I. The median of the examination scores of the candidates is 22 marks.
II. The standard score of each candidate in the examination is lower than 2.
III. The standard deviation of the examination scores of the candidates exceeds 8 marks.

A. I only

B. II only

C. I and III only

D. II and III only

45. If the variance of the seven numbers x_1, x_2, x_3, x_4, x_5, x_6 and x_7 is 16, then the standard deviation of the seven numbers $9x_1-5$, $9x_2-5$, $9x_3-5$, $9x_4-5$, $9x_5-5$, $9x_6-5$ and $9x_7-5$ is

A. 31.

B. 36.

C. 139.

D. 144.

END OF PAPER