

LONGMAN MATHEMATICS SERIES  
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION  
2018  
MOCK PAPER

**MATHEMATICS Compulsory Part  
PAPER 2**

Time allowed: 1 hour 15 minutes

**INSTRUCTIONS**

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first write 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. 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.  $x^2 - y^2 - x + y =$

- A.  $(x - y)(x - y - 1)$ .
- B.  $(x - y)(x + y - 1)$ .
- C.  $(x + y)(x - y - 1)$ .
- D.  $(x + y)(x + y - 1)$ .

2.  $(-4)^{444} \left( \frac{1}{2^{222}} \right) =$

- A.  $-2^{666}$ .
- B.  $-2^{222}$ .
- C.  $2^{222}$ .
- D.  $2^{666}$ .

3. If  $\frac{x+6y}{3x} = \frac{y}{x} + 1$ , where  $x \neq 0$ , then  $x =$

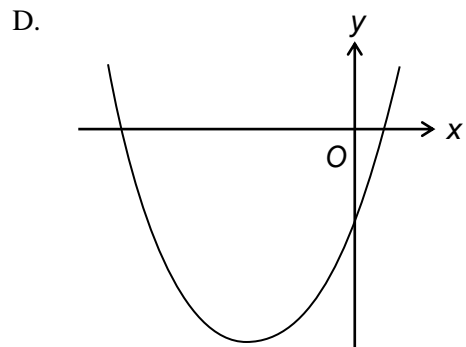
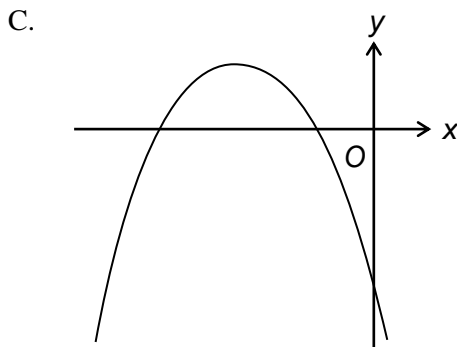
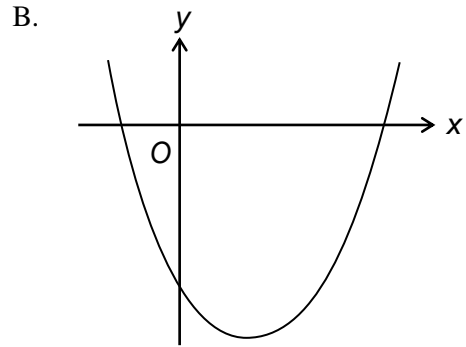
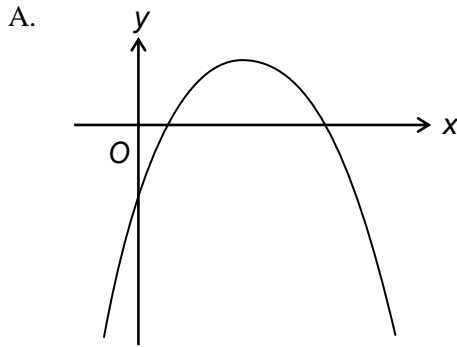
- A.  $\frac{2y}{3}$ .
- B.  $\frac{3y}{2}$ .
- C.  $\frac{2}{3y}$ .
- D.  $\frac{3}{2y}$ .

4.  $\left( \frac{\pi}{5} \right)^3 =$

- A. 0.24 (correct to 2 significant figures).
- B. 0.2480 (correct to 3 decimal places).
- C. 0.2481 (correct to 4 significant figures).
- D. 0.248 10 (correct to 5 decimal places).

5. The solution of  $4 - x < 2 - 3x$  or  $x + 3 > 2x - 5$  is
- A.  $x < -1$ .
  - B.  $x < 8$ .
  - C.  $-1 < x < 8$ .
  - D.  $x < -1$  or  $x > 8$ .
6. If  $a$  and  $b$  are constants such that  $n(x - 3)^2 - 2x \equiv 9x^2 + mx(x + 2) + 18$ , then  $m =$
- A. 7.
  - B. 1.
  - C. -1.
  - D. -7.
7. Let  $f(x) = (x - 1)^3 - 6(x - 1) + 4$ . Which of the following is a factor of  $f(x)$ ?
- A.  $x + 1$
  - B.  $x - 2$
  - C.  $x - 3$
  - D.  $x + 2$
8. If  $k$  is a constant such that  $x^2 + k(x + 5) = 16$  has equal roots, then  $k =$
- A. -8.
  - B. 12.
  - C. 4 or 16.
  - D. 8 or 20.

9. If  $p < 0$  and  $q > 0$ , which of the following may represent the graph of  $y = (px + q)^2 - 3$ ?



10. The price of a toy car is 25% higher than that of a doll. If the total price of the toy car and the doll is \$270, find the difference between the price of the toy car and that of the doll.

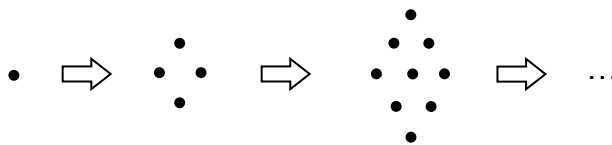
- A. \$30
- B. \$37.5
- C. \$43.2
- D. \$67.5

11. Let  $a$ ,  $b$  and  $c$  be non-zero numbers. If  $\frac{1}{2a} = \frac{1}{3b} = \frac{1}{4c}$ , then  $(a + b) : (b + c) =$

- A. 5 : 6.
- B. 5 : 7.
- C. 10 : 7.
- D. 10 : 9.

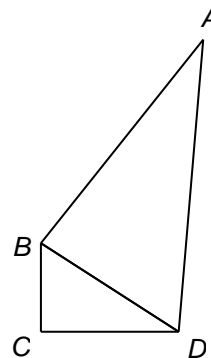
12. It is given that  $z$  varies inversely as  $\sqrt{x}$  and directly as  $y^2$ . If  $x$  is decreased by 36% and  $y$  is increased by 20%, then  $z$  is
- decreased by 16%.
  - decreased by 44%.
  - increased by 50%.
  - increased by 80%.

13. In the figure, the 1st pattern consists of 1 dot. For any positive integer  $n$ , the  $(n + 1)$ th pattern is formed by adding  $(2n + 1)$  dots to the  $n$ th pattern. Which pattern has 81 dots?



- 7th pattern
  - 8th pattern
  - 9th pattern
  - 10th pattern
14. In the figure,  $AB$  is perpendicular to  $BD$  and  $BC$  is perpendicular to  $CD$ . It is given that  $AD = 65$  cm,  $BC = 15$  cm and  $CD = 20$  cm. Find the area of  $ABCD$ .

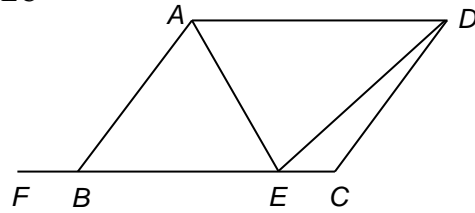
- $160 \text{ cm}^2$
- $900 \text{ cm}^2$
- $1800 \text{ cm}^2$
- $2100 \text{ cm}^2$



15. The base radius of a circular cone is 6 cm. The upper part of the circular cone is cut so that a frustum with height half of the height of the circular cone is made. If the volume of the frustum is  $168\pi \text{ cm}^3$ , find the height of the frustum.
- 2 cm
  - 4 cm
  - 8 cm
  - 12 cm

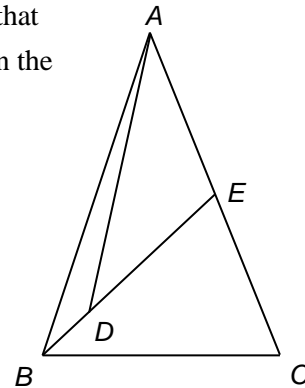
16. In the figure,  $E$  is a point lying on  $BC$  such that  $AB = BE$  and  $AE = DE$ .  $CB$  is produced to  $F$ . If  $AD \parallel FC$  and  $\angle ABF = 132^\circ$ , then  $\angle DEC =$

- A.  $48^\circ$ .
- B.  $58^\circ$ .
- C.  $61^\circ$ .
- D.  $66^\circ$ .



17. In the figure,  $\angle ABC = \angle BEC$ .  $D$  is a point lying on  $BE$  such that  $AB : BD : DE = 8 : 1 : 3$ . If the area of  $\triangle ADE$  is  $18 \text{ cm}^2$ , then the area of  $\triangle ABC$  is

- A.  $32 \text{ cm}^2$ .
- B.  $36 \text{ cm}^2$ .
- C.  $42 \text{ cm}^2$ .
- D.  $48 \text{ cm}^2$ .

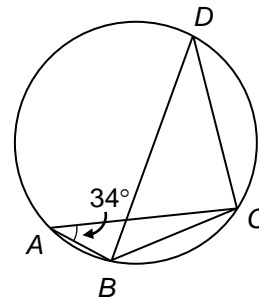


18.  $ABCD$  is a parallelogram. Let  $P, Q, R$  and  $S$  be the mid-points of  $AB, BC, CD$  and  $AD$  respectively. Which of the following must be true?

- I.  $AP = CR$
  - II.  $\angle QPS = \angle SRQ$
  - III.  $\triangle QCR \cong \triangle SDR$
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

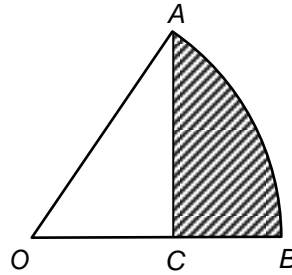
19. In the figure,  $\widehat{AB} = \widehat{BC} = \widehat{CD} = 1 : 2 : 3$ . Then  $\angle ACD =$

- A.  $78^\circ$ .
- B.  $82^\circ$ .
- C.  $98^\circ$ .
- D.  $102^\circ$ .



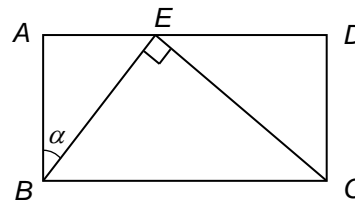
20. In the figure,  $OAB$  is a sector with centre  $O$ .  $C$  is a point on  $OB$  such that  $AC \perp OB$ . If  $\angle AOB = 60^\circ$  and the area of the shaded region is  $32 \text{ cm}^2$ , find the radius of the sector correct to the nearest  $0.1 \text{ cm}$ .

- A.  $7.1 \text{ cm}$   
 B.  $9.7 \text{ cm}$   
 C.  $10.2 \text{ cm}$   
 D.  $18.8 \text{ cm}$



21. In the figure,  $ABCD$  is a rectangle.  $E$  is a point lying on  $AD$  such that  $\angle BEC = 90^\circ$ .  
 If  $\angle ABE = \alpha$ , then  $CE =$

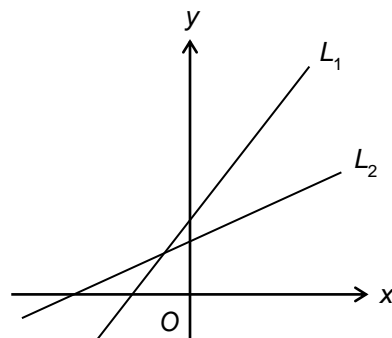
- A.  $AB \tan \alpha$ .  
 B.  $\frac{AB}{\sin \alpha}$ .  
 C.  $AD \tan \alpha$ .  
 D.  $\frac{AD}{\sin \alpha}$ .



22. If the sum of the interior angles of a regular  $n$ -sided polygon is 12 times an exterior angle of the polygon, which of the following is true?
- A. The value of  $n$  is 4.  
 B. Each interior angle of the polygon is  $168^\circ$ .  
 C. The number of diagonals of the polygon is 9.  
 D. The number of folds of rotational symmetry of the polygon is 12.

23. In the figure, the equations of the straight lines  $L_1$  and  $L_2$  are  $ax + by = 1$  and  $cx + 3y = 1$  respectively. Which of the following are true?

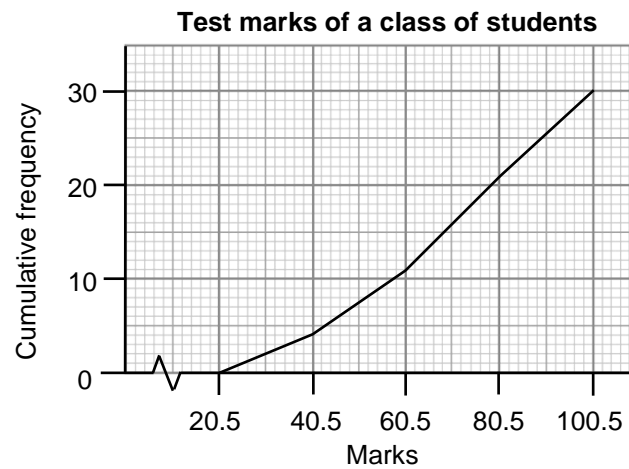
- I.  $a < 0$   
 II.  $0 < b < 3$   
 III.  $c > 0$
- A. I and II only  
 B. I and III only  
 C. II and III only  
 D. I, II and III



24. The straight line  $L_2$  is perpendicular to the straight line  $L_1 : 4x - 3y + 6 = 0$ . If  $L_2$  has the same  $y$ -intercept as  $L_1$ , then the equation of  $L_2$  is
- A.  $3x + 4y - 8 = 0$ .
  - B.  $3x + 4y + 6 = 0$ .
  - C.  $4x - 3y - 8 = 0$ .
  - D.  $4x - 3y + 6 = 0$ .
25. The polar coordinates of the points  $A$ ,  $B$  and  $C$  are  $(4, 40^\circ)$ ,  $(5, 220^\circ)$  and  $(6, 280^\circ)$  respectively. The perpendicular distance from  $C$  to  $AB$  is
- A. 3.
  - B.  $2\sqrt{3}$ .
  - C.  $3\sqrt{3}$ .
  - D. 6.
26. The equation of the circle  $C$  is  $2x^2 + 2y^2 + 20x - 12y + 15 = 0$ . Which of the following are true?
- I. The coordinates of the centre of  $C$  are  $(-5, 3)$ .
  - II. The radius of  $C$  is 11 units.
  - III. The point  $(2, 0)$  lies outside  $C$ .
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
27. It is given that  $A$  and  $B$  are two distinct points on the straight line  $4x - 7y + k = 0$ , where  $k$  is a constant. Let  $P$  be a moving point in the rectangular coordinate plane such that  $AP^2 + BP^2 = AB^2$ . If the equation of the locus of  $P$  is  $x^2 + y^2 - 8x - 6y + 21 = 0$ , find the value of  $k$ .
- A. -16
  - B. -5
  - C. 5
  - D. 16



28. The following cumulative frequency polygon shows the test marks of a class of students.



Find the median mark.

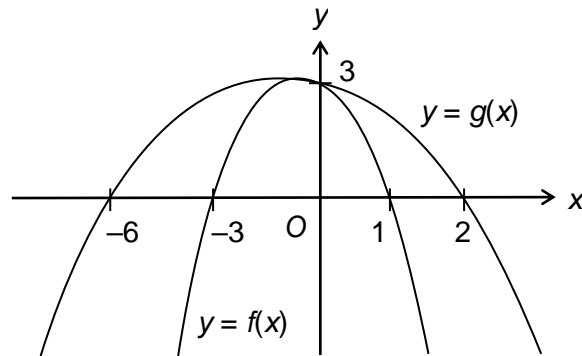
- A. 50.5  
 B. 64.5  
 C. 68.5  
 D. 79.5
29. There are five balls numbered '2', '4', '5', '7' and '9' in a box. In a game, two balls are randomly drawn from the box at the same time. If the sum of the two numbers drawn is odd, 15 tokens will be obtained; otherwise, 25 tokens will be obtained. Find the expected number of tokens obtained in the game.
- A. 19  
 B. 19.8  
 C. 20.2  
 D. 21
30. Consider the following ten positive integers:  
 4 5 7 8 9 10 12  $a$   $b$   $c$   
 If the mean of the above positive integers is 6, which of the following must be true?
- I. Median of the ten integers = 6  
 II. Mode of the ten integers = 1  
 III. Range of the ten integers = 11
- A. I only  
 B. II only  
 C. I and III only  
 D. II and III only

**Section B**

31. The H.C.F. of  $4a^3b^3$ ,  $8a^4$ ,  $12ab^2$  is

- A.  $4a$ .
- B.  $4ab^2$ .
- C.  $24a^4b^3$ .
- D.  $24a^8b^5$ .

32. The figure below shows two quadratic graphs  $y = f(x)$  and  $y = g(x)$  with the same  $y$ -intercept. Which of the following may represent the relationship between  $f(x)$  and  $g(x)$ ?



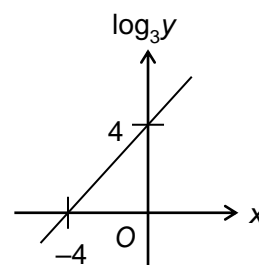
- A.  $f(x) = g(2x)$
- B.  $f(x) = 2g(2x)$
- C.  $g(x) = f(2x)$
- D.  $g(x) = 2f(x)$

33.  $4^{16} + 8^{16} =$

- A.  $10001000_{16}$ .
- B.  $10001000000_{16}$ .
- C.  $100010000000_{16}$ .
- D.  $1000100000000_{16}$ .

34. The graph in the figure shows the linear relation between  $x$  and  $\log_3 y$ . Which of the following must be true?

- A.  $y = 12x$
- B.  $y = 81x$
- C.  $y = 12(3^x)$
- D.  $y = 81(3^x)$



35. Let  $k$  be a real number. If the real part and the imaginary part of  $\frac{k}{2+i} + 4 + i$  are equal, then  $k =$

- A.  $-5$ .
- B.  $-3$ .
- C.  $3$ .
- D.  $5$ .

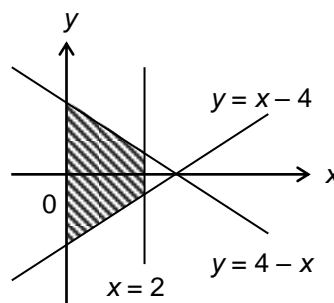
36. If  $x > 1$ , which of the following is/are geometric sequence(s)?

- I.  $\log x, (\log x)^2, (\log x)^3$
- II.  $\log x, \log x^2, \log x^3$
- III.  $\log_2 x, \log_4 x, \log_{16} x$

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

37. If  $(x, y)$  is a point lying in the shaded region bounded by  $y = x - 4$ ,  $y = 4 - x$ ,  $x = 2$  and the  $y$ -axis (including the boundary), what is the greatest value of  $4x + 3y$ ?

- A.  $2$
- B.  $12$
- C.  $14$
- D.  $16$

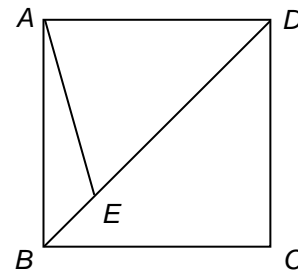


38. For  $0^\circ \leq \theta \leq 360^\circ$ , how many roots does the equation  $\cos^2 x = 2\sin x + 1$  have?

- A. 0
- B. 1
- C. 3
- D. 5

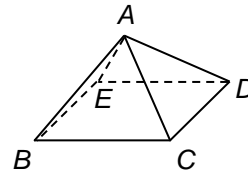
39. In the figure,  $ABCD$  is a square with diagonal  $BD = 5\sqrt{2}$  cm. If  $E$  is a point lying on  $BD$  such that  $\angle AED = 60^\circ$ , then  $AE =$

- A.  $\frac{2\sqrt{3}}{5}$  cm.
- B.  $\frac{5\sqrt{3}}{2}$  cm.
- C.  $\frac{3\sqrt{6}}{5}$  cm.
- D.  $\frac{5\sqrt{6}}{3}$  cm.



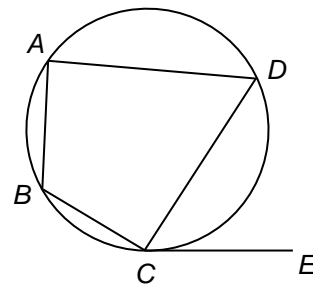
40.  $ABCDE$  is a right pyramid with square base  $BCDE$ . If  $AB = BC$ , find the angle between the adjacent planes  $ABC$  and  $ACD$ , correct to 3 significant figures if necessary.

- A.  $70.5^\circ$
- B.  $90^\circ$
- C.  $109^\circ$
- D.  $141^\circ$



41. In the figure,  $CE$  is the tangent to the circle at  $C$ . If  $AB = BC$  and  $\angle ADC = 46^\circ$ , then  $\angle BCE =$

- A.  $111^\circ$ .
- B.  $134^\circ$ .
- C.  $157^\circ$ .
- D.  $164^\circ$ .



42. The coordinates of  $X$  and  $Y$  are  $(6, -6)$  and  $(6, b)$  respectively. If  $C(a, -2)$  is the circumcentre of  $\triangle OXY$ , where  $O$  is the origin, then  $a + b =$
- 5.
  - 6.
  - 7.
  - 8.
43. There are 15 boys and 10 girls in a choir team. If a group of 5 students is selected from the team to participate in a singing contest and the group consists of at least one boy and at least one girl, how many different groups can be formed?
- 49 875
  - 53 130
  - 242 364
  - 265 650
44. There are 10 bowls in a box, of which 4 of them are red. If 3 bowls are randomly chosen from the box with replacement, find the probability that at most 2 red bowls are chosen.
- $\frac{1}{30}$
  - $\frac{8}{125}$
  - $\frac{117}{125}$
  - $\frac{29}{30}$
45. Let  $m_1, r_1$  and  $v_1$  be the median, the range and the variance of a group of numbers  $\{a - 5, b - 5, c - 5, d - 5, e - 5, f - 5\}$  respectively while  $m_2, r_2$  and  $v_2$  be the median, the range and the variance of the group of numbers  $\{2a, 2b, 2c, 2d, 2e, 2f\}$  respectively. Which of the following must be true?
- $m_2 = 2m_1 + 5$
  - $r_2 = 2r_1$
  - $v_2 = 4v_1$
- I and II only
  - I and III only
  - II and III only
  - I, II and III

**END OF PAPER**