MC

SMCC
PREMOCK 19/20

MATHEMATICS Compulsory Part

PAPER 2

(1 1/4 hours)

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet 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.

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. $\left(\frac{1}{4^{153}}\right)8^{101} =$

   A. 2.

   B. 8.

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

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

2. $(p^2 - pq - q^2)(p + q) =$

   A. $p^3 + q^3$.

   B. $p^3 - 2pq^2 - q^3$.

   C. $p^3 - 2p^2q - q^3$.

   D. $p^3 + 2p^2q - 2pq^2 - q^3$.

3. If $\frac{c}{a-1} - \frac{ab}{1-a} = 3$, then $a =$

   A. $\frac{3+c}{3-b}$.

   B. $\frac{3+c}{3+b}$.

   C. $\frac{3-c}{3-b}$.

   D. $\frac{3-c}{3+b}$.

4. Let a and b be constants. If $5 + (x - a)(x + 5a) \equiv (x - 1)(x + 9) - b$, then $b =$

A. 2.

B. 4.

C. 6.

D. 24.

5. If $f(x) = 2 + 2x - x^2$, then $-f(2) + f(-2) =$

A. -12.

B. -8.

C. 8.

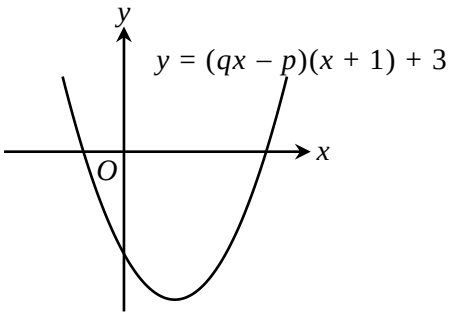
D. 12.

6. Which of the following statements about the graph of $y = (qx - p)(x + 1) + 3$ is/are true?

I. $q > 0$

II. $p > 3$

III. The x-intercepts of the graph are $\frac{p}{q}$ and -1.



A. II only

B. I and II only

C. I and III only

D. I, II and III

7. The solution of $\frac{6x-1}{7} > 5$ or $4 - 3(1 - x) > 7$ is

A. $x > 2$.

B. $x > 6$.

C. $2 < x < 6$.

D. $x < 2$ or $x > 6$.

8. Let $p(x) = x^3 + kx^2 + 4x - 16$, where k is a constant. If $p(x)$ is divisible by $x + k$, find the remainder when $p(x)$ is divided by $x + 2$.

A. -48

B. -16

C. -4

D. 16

9. A sum of \$94 000 is deposited at an interest rate of 4% per annum for 3 years, compounded monthly. Find the amount correct to the nearest dollar.

A. \$105 280

B. \$105 737

C. \$105 922

D. \$105 964

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

A. 1 : 1.

B. 3 : 7.

C. 6 : 7.

D. 9 : 7.

11. If z varies directly as the cube of x and inversely as the square root of y, which of the following must be constant?

A. $\frac{xz^2}{y^6}$

B. $\frac{yz^2}{x^6}$

C. $\frac{x^6z^2}{y}$

D. $\frac{y^6z^2}{x}$

12. There is a box of red beans. The weight of red beans in the box is measured as 2 kg correct to the nearest kg. If the box of red beans is divided into n bags such that the weight of red beans in each bag is measured as 40 g correct to the nearest g, find the greatest possible value of n.

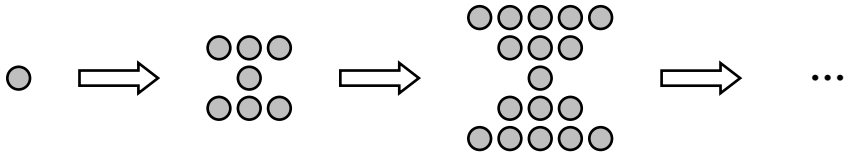
A. 37

B. 61

C. 63

D. 64

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 $(4n + 2)$ dots to the nth pattern. Find the number of dots in the 7th pattern.



A. 30

B. 91

C. 97

D. 127

14. Let l cm and r cm be the slant height and the base radius of a solid right circular cone respectively. If $l : r = 17 : 8$ and the curved surface area of the cone is 34π cm^2, then the volume of the cone is

A. 40π cm^3.

B. 80π cm^3.

C. $\frac{136\pi}{3}$ cm^3.

D. $\frac{272\pi}{3}$ cm^3.

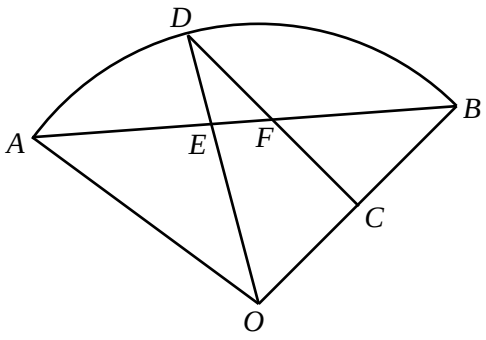
15. The figure shows the sector $OADBC$ with radius 12 cm. CD is the perpendicular bisector of OB. OD and CD cut AB at E and F respectively. If $\angle AED = 75°$, then the area of the sector OAD is

A. π cm^2.

B. 12π cm^2.

C. 18π cm^2.

D. 24π cm^2.



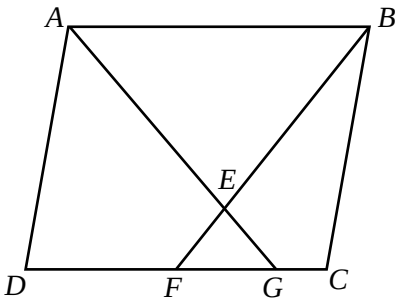
16. In the figure, $ABCD$ is a parallelogram. F and G are points on DC such that $DF : FG : GC = 3 : 2 : 1$. AG cuts BF at E. If the area of the quadrilateral $BCGE$ is 1 265 cm^2, then the area of $\triangle EBA$ is

A. 1 980 cm^2.

B. 2 277 cm^2.

C. 2 530 cm^2.

D. 3 036 cm^2.



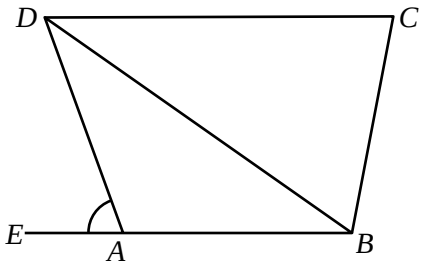
17. In the figure, EAB is a straight line. DC // EB, $AD = AB$ and $DB = DC$. If $\angle DCB = 4\angle BDC$, then $\angle DAE =$

A. 40°.

B. 60°.

C. 75°.

D. 80°.



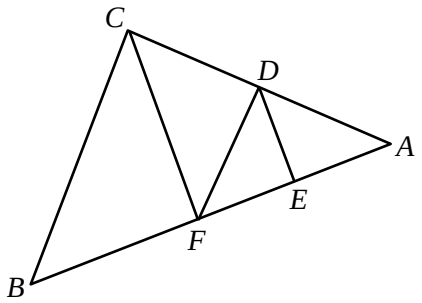
18. In the figure, D is a point on AC. E and F are points on AB such that $DE \perp AB$ and $CF \perp AB$. If $AE = EF = 6$ cm, $FB = 12$ cm and $DC = 10$ cm, then $BC =$

A. 16 cm.

B. 20 cm.

C. 24 cm.

D. 25 cm.



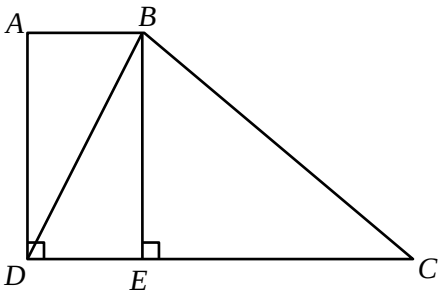
19. In the figure, $ABCD$ is a right-angled trapezium, where AB // DC and $AD \perp DC$. E is a point on DC such that $BE \perp DC$. If $BD = 13$ cm, $BC = 20$ cm and $EC = 16$ cm, find the perimeter of $ABCD$.

A. 44 cm

B. 53 cm

C. 58 cm

D. 71 cm



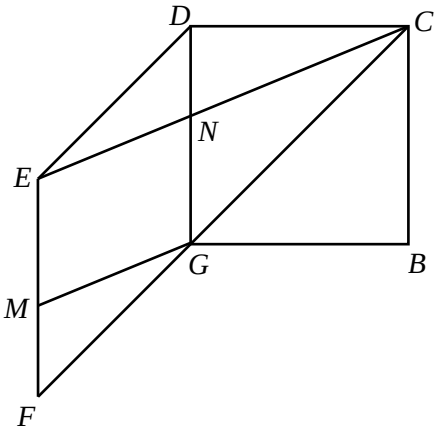
20. In the figure, $BCDG$ is a square and $DEFG$ is a rhombus. CGF is a straight line. CE and DG intersect at N. M is a point on EF such that $ENGM$ is a parallelogram. $\angle EMG =$

A. 45°.

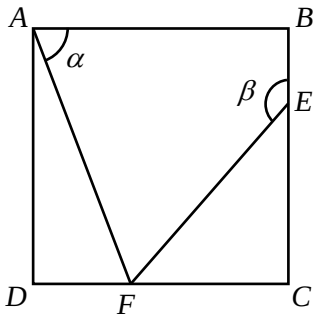
B. 60°.

C. 62.5°.

D. 67.5°.



21. In the figure, $ABCD$ is a square. E is a point on BC and F is a point on CD. Find $\frac{AF}{EF}$.



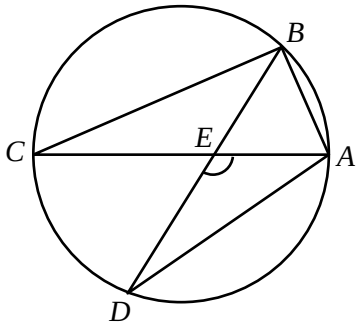
A. $\frac{-\cos\beta}{\sin\alpha}$

B. $\frac{\sin\alpha}{\cos\alpha+\sin\beta}$

C. $\frac{\cos\beta}{\sin\alpha-\cos\alpha}$

D. $\frac{\sin\beta}{\sin\alpha-\cos\alpha}$

22. In the figure, AC is a diameter of the circle $ABCD$. AC and BD intersect at E. If $\overset{\frown}{BC}$ = 24 cm, $\overset{\frown}{CD}$ = 16 cm and $\angle BAC = 63°$, then $\angle AED$ =



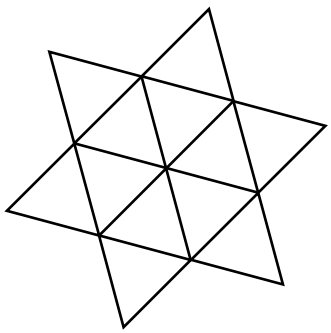
A. 96°.

B. 105°.

C. 111°.

D. 126°.

23. The figure below is made up of twelve identical equilateral triangles. The number of axes of reflectional symmetry of the figure is



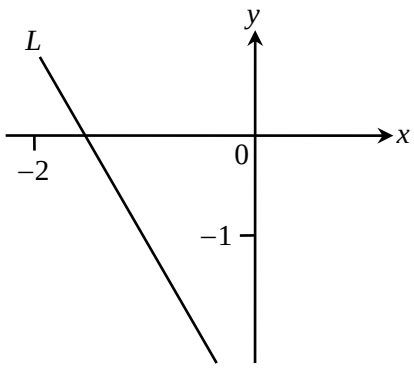
A. 2.

B. 3.

C. 6.

D. 12.

24. In the figure, the equation of the straight line L is $ax + 5y = b$. Which of the following are true?



I. $a > 0$

II. $b < -5$

III. $b + 2a > 0$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

25. The equation of the straight line L is $3x - 5y + 24 = 0$. A and B are two fixed points on L. If P is a moving point in the rectangular coordinate plane such that the area of $\triangle PAB$ is 3, then the locus of P is

A. a circle.

B. a straight line.

C. a parabola.

D. a pair of straight lines.

26. The equation of the straight line L is $3x + 2y + 4 = 0$. The equation of the straight line passing through $(5 , 1)$ and perpendicular to L is

A. $2x + 3y + 13 = 0$.

B. $2x - 3y + 7 = 0$.

C. $2x + 3y - 13 = 0$.

D. $2x - 3y - 7 = 0$.

27. The equations of the circles C_1 and C_2 are $x^2 + y^2 - 8x - 6y + 20 = 0$ and $2x^2 + 2y^2 + 12x - 16y + 33 = 0$ respectively. Let G_1 and G_2 be the centres of C_1 and C_2 respectively. Denote the origin by O. Which of the following is/are true?

I. G_1O is perpendicular to G_2O.

II. The area of C_1 is greater than the area of C_2.

III. O is equidistant from G_1 and G_2.

A. I only

B. II only

C. I and III only

D. II and III only

28. Two numbers are randomly selected at the same time from the eight numbers 4, 5, 6, 7, 8, 9, 10 and 11 respectively. Find the probability that the sum of the two numbers selected is not greater than 11.

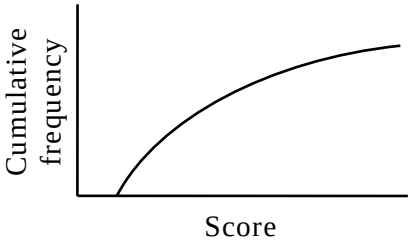
A. $\frac{1}{7}$

B. $\frac{1}{14}$

C. $\frac{3}{32}$

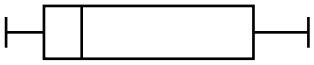
D. $\frac{5}{32}$

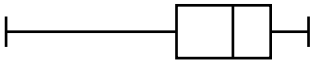
29. **Scores of a group of students in a test**

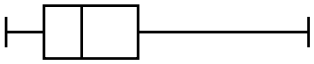


The cumulative frequency curve above shows the distribution of the scores of a group of students in a test. Which of the following box-and-whisker diagrams may represent the distribution?

A. 

B. 

C. 

D. 

30. Consider the following set of data:

a *b* *c* *d* 90 90 19 60 76 90 78 81

If the mean and the mode of the above set of data are 70 and 60 respectively, then the median of the above set of data is

A. 68.

B. 76.

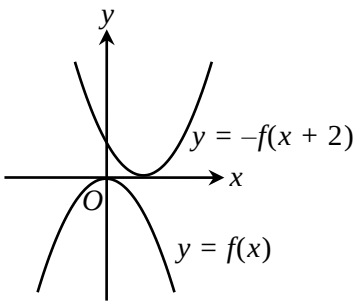
C. 77.

D. 85.

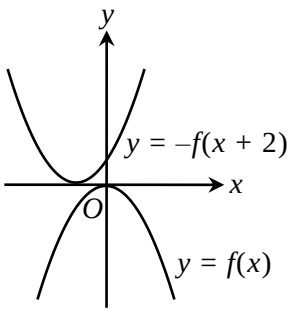
Section B

31. Which of the following may represent the graph of $y = f(x)$ and the graph of $y = -f(x + 2)$ in the same rectangular coordinate plane?

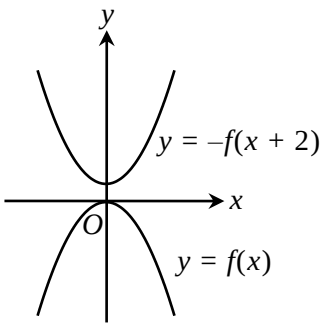
A.



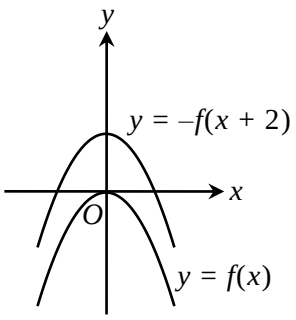
B.



C.



D.



32. 1001001000011010_2 =

A. $73 \times 2^9 + 26$.

B. $73 \times 2^{10} + 52$.

C. $146 \times 2^9 + 26$.

D. $146 \times 2^{10} + 52$.

33. It is given that $\log_4 y$ is a linear function of $\log_8 x$. The slope and the intercept on the horizontal axis of the graph of the linear function are -3 and $\frac{1}{3}$ respectively. Which of the following must be true?

A. $x^2y = 4$

B. $x^6y^3 = 4$

C. $4x^2y = 1$

D. $4x^6y^3 = 1$

34. Which of the following is the least?

A. -111^{589}

B. -123^{577}

C. -135^{565}

D. -147^{553}

35. If m is a real number, then the imaginary part of $i^7 + \dfrac{i^5 - 4}{m - i}$ is

A. $\dfrac{m - m^2 - 5}{m^2 + 1}$.

B. $\dfrac{m - m^2 - 5}{m^2 - 1}$.

C. $\dfrac{m - 4}{m^2 + 1}$.

D. $\dfrac{m - 4}{m^2 - 1}$.

36. Consider the following system of inequalities:

$$\begin{cases} 7x + y \le 20 \\ 2x + 3y \ge 3 \\ 5y - 3x \le 24 \end{cases}$$

Let T be the region which represents the solution of the above system of inequalities. If (x, y) is a point lying in T, then the greatest value of $4y - 3x - 5$ is

A. -18.

B. 13.

C. 16.

D. 21.

37. Let T_n be the nth term of a geometric sequence. If $T_3 = 192$ and $T_8 = 6$, which of the following is/are true?

I. The common ratio of the sequence can be negative.

II. Only 17 terms of the sequence are greater than 10^{-2}.

III. The sum of the first 13 terms of the sequence is greater than 1 535.

A. I only

B. III only

C. I and II only

D. II and III only

38. For $0° \leq \theta \leq 360°$, how many roots does the equation $4\cos^2\theta - 7\sin\theta - 7 = 0$ have?

A. 1

B. 2

C. 3

D. 4

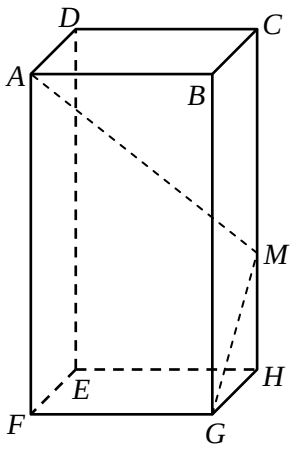
39. In the figure, $ABCDEFGH$ is a rectangular block, where $AB = 16$ cm, $BC = 12$ cm and $BG = 30$ cm. M is a point on CH such that $CM : MH = 7 : 3$. Denote the angle between MA and MG by θ. Find $\cos\theta$.

A. $-\frac{3}{29}$

B. $-\frac{6}{29}$

C. $\frac{9}{17}$

D. $\frac{16}{17}$



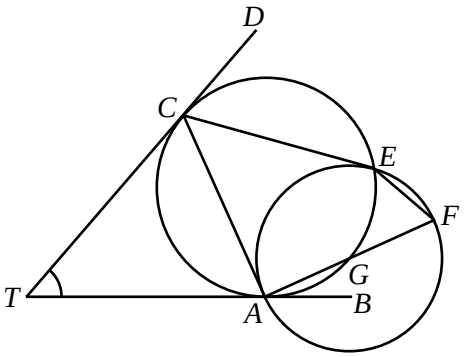
40. In the figure, *TAB* and *TCD* are tangents to the circle *ACEG*. *G* is the centre of the circle *AEF* and *AGF* is a diameter of the circle. If $\overset{\frown}{AC} : \overset{\frown}{CE} = 6 : 5$ and $\angle AFE = 66°$, then $\angle ATC =$

A. 36°.

B. 48°.

C. 66°.

D. 72°.



41. Let *O* be the origin. The coordinates of the points *A* and *B* are (−10 , 0) and (0 , *b*) respectively, where $b > 0$. The in-centre *G* of $\triangle OAB$ lies on the straight line $4y + x = 3kb$, where $k \neq 1$. Which of the following are true?

I. The *x*-coordinate and the *y*-coordinate of *G* are not equal.

II. The distance from *G* to *AB* is $\dfrac{5(1-2k)}{1-k}$.

III. When $k = \dfrac{1}{6}$, the straight line $3x + y = 5$ is a tangent to the inscribed circle of $\triangle OAB$.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

42. Alan, Ben, Chris and 9 other people queue in a row and wait for a bus. If any two of Alan, Ben and Chris do not stand next to each other, how many different possible queues are there?

A. 1 088 640

B. 182 891 520

C. 261 273 600

D. 457 228 800

43. There are three boxes *A*, *B* and *C*. Each box contains 8 balls. 2 of the balls in box *A*, 3 of the balls in box *B* and 4 of the balls in box *C* are yellow balls. Simon randomly draws one ball from each box. Find the probability that Simon draws at least 1 yellow ball from these boxes.

A. $\frac{3}{64}$

B. $\frac{15}{64}$

C. $\frac{49}{64}$

D. $\frac{61}{64}$

44. In a test, the mean of the test scores is 64. The test score of Mandy is 76 and her standard score is 1.5. If the test score of Anson in the test is 54, then his standard score is

A. -1.

B. -1.25.

C. -1.5.

D. -1.75.

45. Consider a set of numbers. 3 is added to each number of the set, and then each resulting number is divided by 4. The new set of numbers formed has the mean m and the variance v. Which of the following must be true?

	Mean of the original set of numbers	Variance of the original set of numbers
A.	$4(m - 3)$	$4v$
B.	$4(m - 3)$	$16v$
C.	$4m - 3$	$4v$
D.	$4m - 3$	$16v$

END OF PAPER