MATH CP
PAPER 2

M C

S6 Mock Examination (2020 – 2021)
Mathematics Compulsory Part
PAPER 2
(1 hour 15 minutes)

Name:___________________
Class: ________ No.: ______

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. $\left(\dfrac{1}{4^{333}}\right)2^{777} =$

   A. 2^{444}.

   B. 2^{111}.

   C. $\dfrac{1}{2^{111}}$.

   D. $\dfrac{1}{2^{444}}$.

2. If $2-\dfrac{a}{2+a}=b$, then $a =$

   A. $\dfrac{4-2b}{1+b}$.

   B. $\dfrac{4-2b}{1-b}$.

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

   D. $\dfrac{2b-4}{1-b}$.

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

   A. p^3+q^3.

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

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

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

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. Let c be a constant. If $f(x) = -x^2 + 2x + c$ and $f(3) + f(-3) = 10$, then $f(1) =$

A. 5.

B. 6.

C. 11.

D. 15.

6. Figure 1 shows the graph of $y = ax(x + b) - c$, where a, b and c are constants. Which of the following are true?

I. $a > 0$

II. $c < 0$

III. $b^2 < -\frac{4c}{a}$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

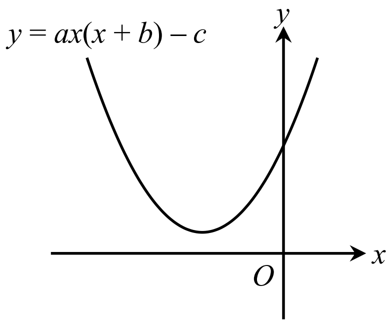


Figure 1

7. The greatest integer satisfying the compound inequality $-3(x-1)+1>4$ and $\frac{2x+1}{5}<2$ is

A. 5.

B. 0.

C. 4.

D. −1.

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 \$$P$ is deposited at an interest rate of 4% per annum for 5 years, compounded half-yearly. If the interest received is \$2 965, find P correct to the nearest integer.

A. 13 539

B. 13 685

C. 28 340

D. 28 487

10. The costs of coffee of brand A and brand B are \$210/kg and \$140/kg respectively. If x kg of coffee of brand A and y kg of coffee of brand B are mixed and the cost of the mixture is \$170/kg, then $x : y =$

A. 2 : 3.

B. 3 : 2.

C. 3 : 4.

D. 4 : 3.

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 Figure 2, the 1st pattern consists of 1 dot. For any positive integer n, the $(n + 1)$th pattern is formed by adding $(2n + 2)$ dots to the nth pattern. Find the number of dots in the 7th pattern.

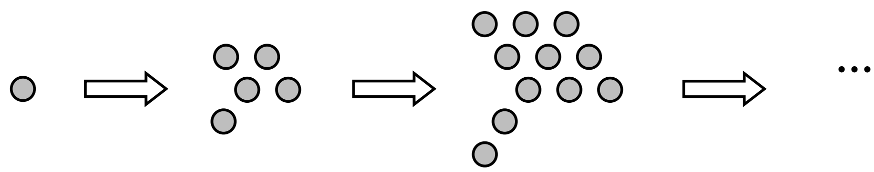


Figure 2

A. 41

B. 55

C. 67

D. 71

14. If the volume of a right circular cylinder of base radius $2a$ cm and height $5b$ cm is 280 cm^3, then the volume of a right circular cone of base radius $3a$ cm and height $6b$ cm is

A. 168 cm^3.

B. 252 cm^3.

C. 504 cm^3.

D. 756 cm^3.

15. Figure 3 shows the semi-circle PQR with centre O. S is a point lying on PQ such that OS // RQ. If OS = 1 cm and $PS = \sqrt{3}$ cm, find the area of the shaded region.

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

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

C. $\left(\sqrt{3}+\frac{\pi}{3}\right)$ cm^2

D. $\left(\sqrt{3}+\frac{2\pi}{3}\right)$ cm^2

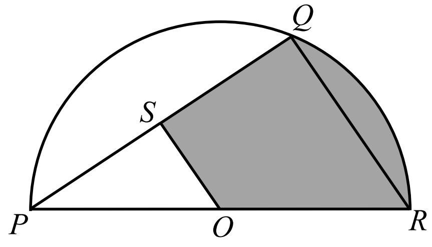


Figure 3

16. In Figure 4, $ABCD$ 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.

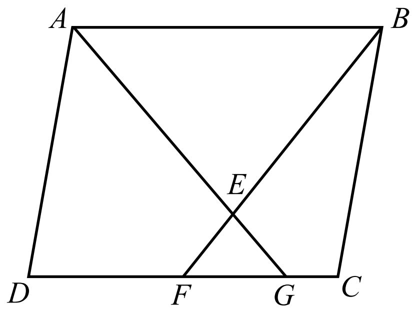


Figure 4

17. In Figure 5, ABC is an isosceles triangle with $AB = AC$. D and E are points lying on AC and BC respectively such that $AD = AE = DE$. If $\angle BAE = 32°$, then $\angle DEC =$

A. 16°.

B. 18°.

C. 20°.

D. 22°.

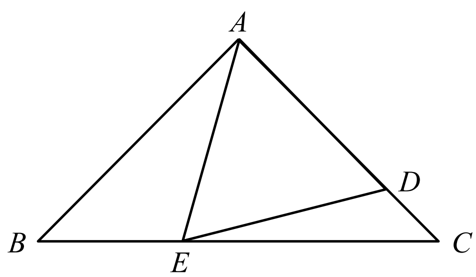


Figure 5

18. In Figure 6, 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.

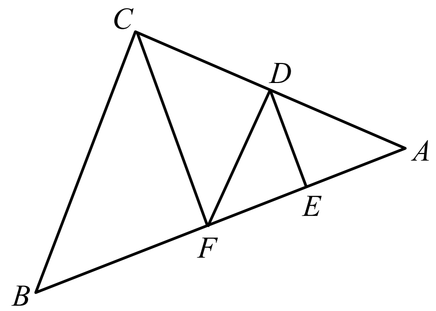


Figure 6

19. In Figure 7, FCB is a straight line and it is an angle bisector of $\angle AFE$. It is given that $\angle ABC = \angle BCD = \angle CDE = 90°$, $AB = 12$ cm, $BC = 4$ cm, $CD = 4$ cm and $DE = 2$ cm. Find the perimeter of $ABCDEF$.

A. 39 cm

B. 40 cm

C. 41 cm

D. 42 cm

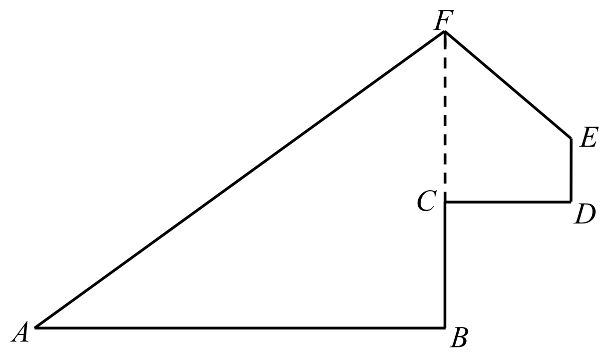


Figure 7

20. In Figure 8, $ABCD$ is a square. E is a point on BC and F is a point on CD. Find $\dfrac{AF}{EF}$.

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

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

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

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

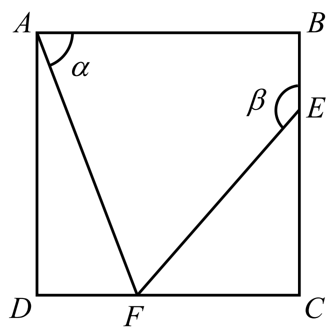


Figure 8

21. In Figure 9, $ABCD$ is a circle. If $AB = AC = 12\text{ cm}$, $\angle ABC = 70°$ and $\angle ACD = 20°$, find CD correct to the nearest cm.

A. 8 cm
B. 9 cm
C. 10 cm
D. 11 cm

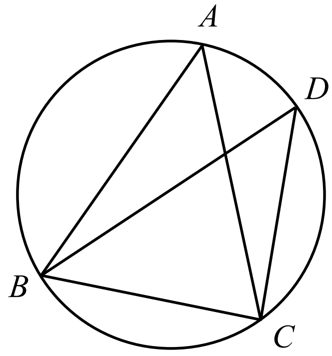


Figure 9

22. In Figure 10, O is the centre of the circle $ABCD$. AC and OB meet at E. If $\overset{\frown}{AD} : \overset{\frown}{DC} = 1 : 2$, $\angle BAC = 32°$ and $\angle BEC = 79°$, then $\angle CAD =$

A. 69°.
B. 70°.
C. 72°.
D. 79°.

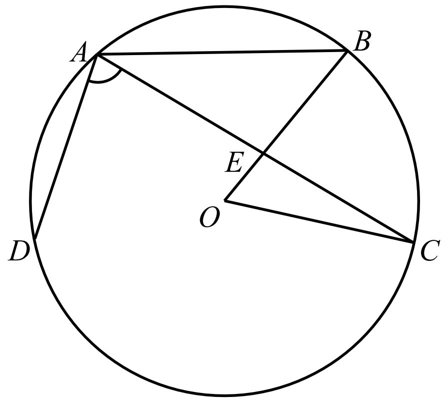


Figure 10

23. Figure 11 below consists of twelve identical squares and some of the squares are shaded. The number of folds of rotational symmetry of the figure is

A. 2.
B. 3.
C. 4.
D. 8.

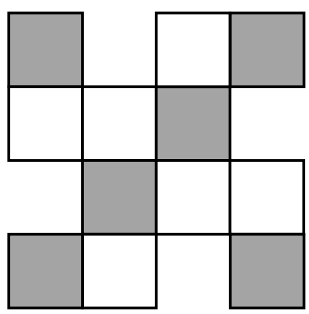


Figure 11

24. In Figure 12, the equations of the straight lines L_1 and L_2 are $5x + py = q$ and $rx + 2y = s$ respectively. Which of the following is/are true?

I. $pr < 10$

II. $5s > qr$

III. $p + q > 0$

A. I only

B. II only

C. I and III only

D. II and III only

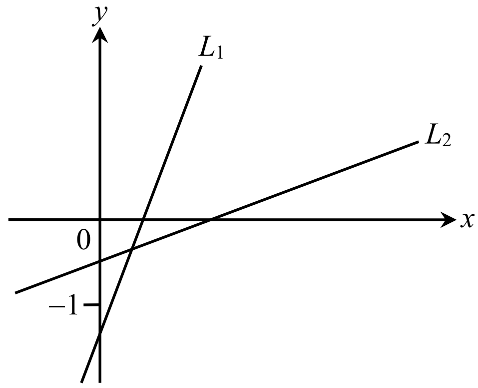


Figure 12

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_1 is $ax - (b + 1)y + 2b = 0$. If the x-intercept of L_1 is -3 and L_1 is parallel to the straight line L_2: $2x + y + ab = 0$, then $a =$

A. -2.

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

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

D. 2.

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 drawn at the same time from six cards numbered 1, 2, 4, 5, 7, 8 respectively. Find the probability that the sum of the numbers is less than 10.

A. $\frac{3}{10}$

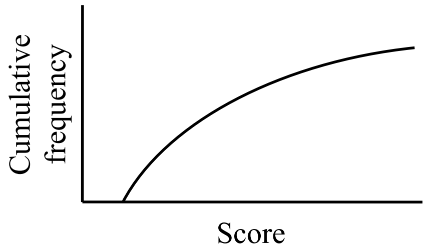
B. $\frac{1}{3}$

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

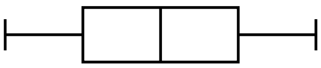
D. $\frac{3}{5}$

29.

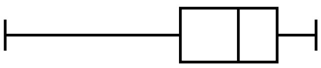
Scores of a group of students in a test

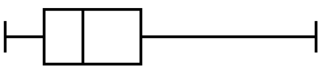


The cumulative frequency curve above shows the distribution of the scores of a group of students in a test. Which of the following box-and-whisker diagrams may represent the distribution?

A. 

B. 

C. 

D. 

30. Consider the following integers:

15 16 17 19 19 19 19 28 a b c

Let k, ℓ and m be the mean, the mode and the median of the above integers respectively. If the range of the above integers is 14, which of the following must be true?

I. $k = 19$

II. $\ell = 19$

III. $m = 19$

A. II only

B. III only

C. I and II only

D. II and III only

Section B

31. $C0000000010_{16} + 10000000001_2 =$

A. $3 \times 2^{40} + 2^{10} + 11$.

B. $3 \times 2^{40} + 2^{11} + 17$.

C. $3 \times 2^{42} + 2^{10} + 17$.

D. $3 \times 2^{42} + 2^{11} + 11$.

32. If the roots of the equation $\pi^{2x} - 9\pi^{x} + 20 = 2$ are m and n, then $m + n =$

A. π^9.
B. $\log_\pi 9$.
C. $\log_\pi 18$.
D. $\log_\pi 20$.

33. Figure 13 shows the graph of $y = a^x$ and the graph of $y = \log_b x$ on the same rectangular coordinate system, where a and b are positive constants. The graph of $y = a^x$ is the reflection image of the graph of $y = \log_b x$ with respect to the straight line $y = x$. The graph of $y = a^x$ intersects the y-axis at P. The graph of $y = \log_b x$ intersects the x-axis at Q. Which of the following are true?

I. $0 < a < 1$

II. $\frac{a}{b} = 1$

III. The area of $\triangle OPQ$ is $\frac{1}{2}ab$.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

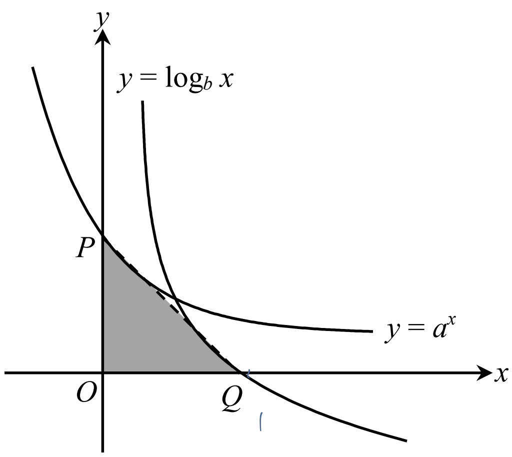


Figure 13

34. Figure 14 shows the linear relation between $\sqrt{x}$ and y^5, then $x =$

A. $\frac{9}{4}(2-y^5)^2$.

B. $\frac{9}{2}(2-y^5)$.

C. $\sqrt{\frac{3}{2}(2-y^5)}$.

D. $\sqrt{\frac{2}{3}(2-y^5)}$.

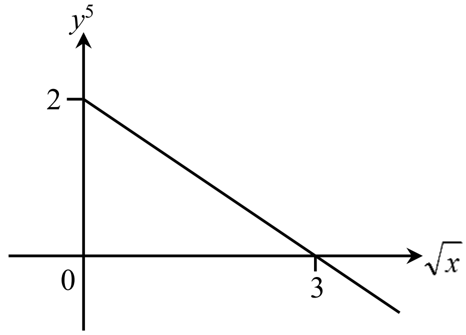


Figure 14

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

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

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

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

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

36. Consider the following system of inequalities:

$$\begin{cases} 3x - y \geq -4 \\ 4x + y \leq 32 \\ x + 9y \geq 8 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. If (x , y) is a point lying in R, then the least value of $6x + 8y + 9$ is

A. 9.

B. 11.

C. 57.

D. 161.

37. If the sum of the first n terms of a sequence is $n(15 - 2n)$, which of the following is/are true?

I. -29 is a term of the sequence.

II. The sum of the 4th term and the 7th term of the sequence is smaller than 0.

III. The sequence is an arithmetic sequence.

A. I only

B. II only

C. I and III only

D. II and III only

38. For $0° \le \theta \le 360°$, 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 Figure 15, $VABCD$ is a pyramid, where its base $ABCD$ is a rectangle. $\triangle VBC$ is an equilateral triangle. X and Y are the mid-points of VC and BC respectively. If $AB = 4$ cm, $BC = 6$ cm and $AX = 4k$ cm, find the area of $\triangle AXY$.

A. $2\sqrt{(1-k^2)(4k^2-1)}$ cm²

B. $2\sqrt{(k^2-1)(4k^2-1)}$ cm²

C. $2\sqrt{(4-k^2)(4k^2-1)}$ cm²

D. $2\sqrt{(k^2-4)(4k^2-1)}$ cm²

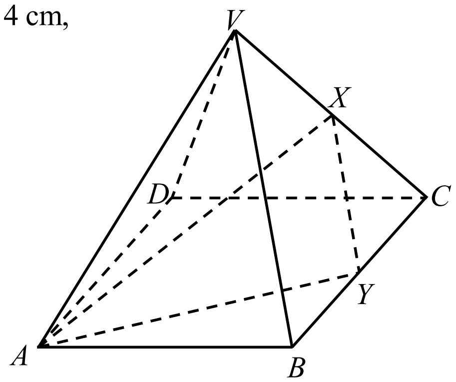


Figure 15

40. In Figure 16, 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°.

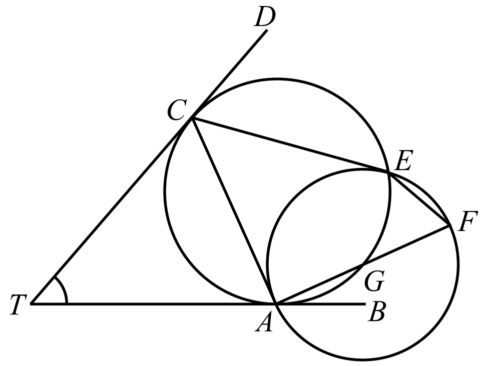


Figure 16

41. It is given that k is a non-zero constant. The straight line $2x - 4y = k$ cuts the x-axis and the y-axis at the points A and B respectively. Let C be a point lying on the x-axis such that the centroid of ΔABC lies on the y-axis. Find the x-coordinate of C in terms of k.

A. $-\dfrac{k}{2}$

B. $-\dfrac{k}{4}$

C. $-\dfrac{k}{8}$

D. $-\dfrac{k}{16}$

42. Find the range of values of k such that the circle $x^2 + y^2 + 4x + ky + 3 = 0$ and the straight line $2x - y + k = 0$ do not intersect.

A. $k < 1$ or $k > 11$

B. $k < -1$ or $k > 11$

C. $1 < k < 11$

D. $-1 < k < 11$

43. In a group, the students are from class A, class B and class C. The following table shows the distribution of the students in the group.

Class	Number of students
A	5
B	3
C	4

If 6 students are randomly selected at the same time from the group, find the number of ways that at most 3 students from class A are selected.

A. 462

B. 805

C. 812

D. 917

44. In a test, the scores of Alan and Betty are 67 and 82 respectively. Let m and n be the standard scores of Alan and Betty respectively. If $\frac{m}{n} = -\frac{3}{2}$, then the mean of the scores in the test is

A. 57.

B. 71.

C. 73.

D. 76.

45. Let a and b be positive constants. The variance of $x - a$, $x + 1$, $x + 3$ and $x + a$ is $b^2 - 2$. The variance of $x - 2a$, $x + 2$, $x + 6$ and $x + 2a$ is $14b$. Find b.

A. 3

B. 4

C. 5

D. 6

END OF PAPER