Mock Exam
MATH CP
PAPER 2

Date : 16th Feb, 2022

Period : 2

Ying Wa Girls' School
Mock Examination 2021-2022

MATHEMATICS Compulsory Part
PAPER 2

1 hour and 15 minutes

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet. Write down 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 should use an HB pencil to mark all your answers on the Answer Sheet. Wrong marks must 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. The solution of $5-3x>11$ or $2x+5>13$ is

   A. no solutions.

   B. $x > -2$.

   C. $x > 4$.

   D. $x < -2$ or $x > 4$.

2. $\dfrac{1}{4x-7}-\dfrac{1}{4x+7}=$

   A. $\dfrac{14}{4x^2+49}$.

   B. $\dfrac{8x}{16x^2-49}$.

   C. $\dfrac{14}{16x^2-49}$.

   D. $\dfrac{-14}{16x^2-49}$.

3. Let a and b be constants. If $x^2 + ax + b(x+1) \equiv (x+3)(x-2)$, the a =

   A. -6.

   B. -5.

   C. 1.

   D. 7.

4. If $f(x)=(4k+7)x^2-2x+5$ and $f(-1)=f(2)$, then k =

   A. $\dfrac{5}{4}$.

   B. $-\dfrac{4}{5}$.

   C. $-\dfrac{5}{4}$.

   D. $-\dfrac{19}{12}$.

5. The rectangular coordinates of the point A are $(1, -\sqrt{3})$. If A is rotated clockwise about the origin through 90° and then reflected with respect to the x-axis, then the polar coordinates of its image are

A. $(2,\ 120°)$.

B. $(2,\ 150°)$.

C. $(2,\ 300°)$.

D. $(2,\ 330°)$.

6. The length and the width of a rectangle are measured as 12 cm and 8 cm correct to the nearest cm. Let A cm^2 be the actual area of the rectangle. Find the range of values of A.

A. $39.5 \le A < 40.5$

B. $77 \le A < 117$

C. $86.25 \le A < 106.25$

D. $95.5 \le A < 96.5$

7. A sum of \$20 000 is deposited at an interest rate of 6% per annum for 5 years, compounded monthly. Find the amount correct to the nearest dollar.

A. \$26 997

B. \$26 977

C. \$26 937

D. \$26 765

8. The costs of tea of brand A and brand B are \$250/kg and \$385/kg respectively. If x kg of tea of brand A and y kg of tea of brand B are mixed so that the cost of the mixture is \$304/kg, then $x : y =$

A. $3 : 2$.

B. $2 : 3$.

C. $9 : 4$.

D. $4 : 9$.

9. A ship is 80 km due east of a pier. If the ship moves in the direction of N55°W, find the shortest distance between the ship and the pier correct to nearest km.

A. 66 km

B. 56 km

C. 49 km

D. 46 km

10. A sequence is defined by $T(n) = T(n-1) + T(n-2)$ for $n \geq 3$ and n is an integer with $T(1) = 2$ and $T(2) = 4$. Find $T(5) + T(7)$.

A. 58

B. 42

C. 26

D. 22

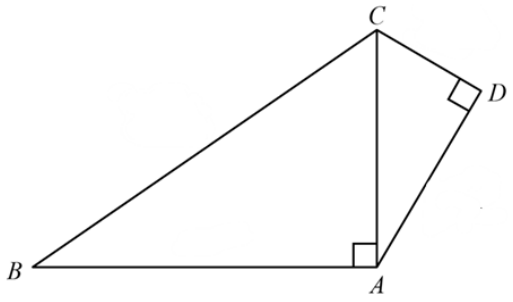
11. In the figure, $CD = 9$ cm, $AD = 12$ cm and $CB = 39$ cm. The area of quadrilateral $ABCD$ is

A. 324 cm^2.

B. 340.5 cm^2.

C. 346.5 cm^2.

D. 648 cm^2.



12. Find the constant k such that the straight lines $kx + 7y + 9 = 0$ and $kx - 7y + k = 0$ are perpendicular to each other.

A. 0

B. 7

C. -7

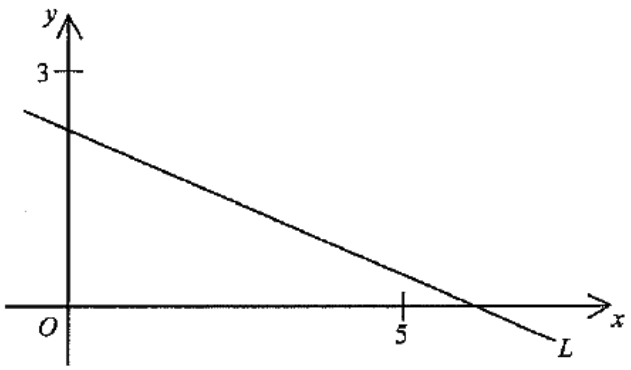
D. 7 or -7

13. In the figure, the equation of the straight line L is $ax + by + 45 = 0$. Which of the following are true?

I. $a > b$

II. $-9 < a < 0$

III. $b < -15$



A. I and II only

B. I and III only

C. II and III only

D. I, II and III

14. Let a be a constant. If the quadratic equation $x^2 + 2ax + 6 = a$ has equal roots, then a =

A. 2.

B. -3.

C. 2 or 3.

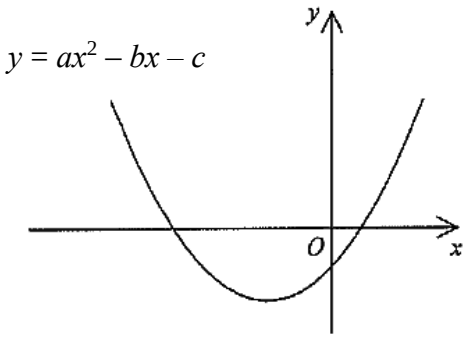
D. 2 or -3.

15. The figure shows the graph of $y = ax^2 - bx - c$, where a, b and c are constants and $a \neq 0$. Which of the following is true?

I. $a > 0$

II. $b > 0$

III. $c > 0$



A. I only

B. I and II only

C. I and III only

D. I, II and III only

16. Let f (x) = $20x^3 + kx^2 - 5x - 3$, where k is a constant. If f (x) is divisible by $5x + 3$, find the remainder when f (x) is divided by $x + 1$.

A. -7

B. -6

C. 0

D. 24

17. It is known that y varies inversely as x^2. If x is decreased by 20%, then y is

A. increased by 56.25%.

B. increased by 150%.

C. decreased by 64%.

D. decreased by 20%.

18. The base of a right pyramid is an equilateral triangle of side 20 cm. If the height of the pyramid is 13 cm, find the total surface area of the pyramid correct to the nearest cm^2.

A. 600 cm^2

B. 550 cm^2

C. 520 cm^2

D. 315 cm^2

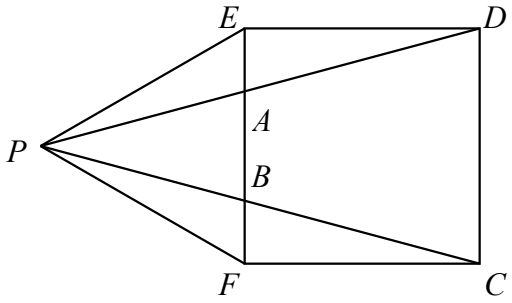
19. In the figure, $CDEF$ is a square and PEF is an equilateral triangle. PAD and PBC are straight lines. $\angle DAF =$

A. 95°.

B. 105°.

C. 110°.

D. 120°.



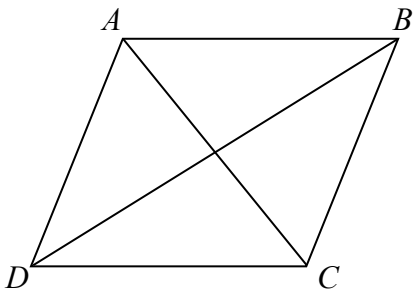
20. In the figure, $ABCD$ is a rhombus. The length of the diagonal AC is 10 cm and the area of the rhombus is 120 cm^2. Find the length of a side of the rhombus.

A. 10 cm

B. 12 cm

C. 13 cm

D. 24.5 cm



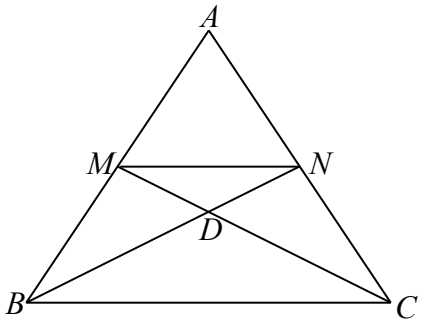
21. In the figure, M and N are the mid-points of AB and AC respectively. BN and CM intersect at D. The area of ΔDMN is 1 cm^2. The area of $MNCB$ is

A. 4 cm^2.

B. 8 cm^2.

C. 9 cm^2.

D. 12 cm^2.



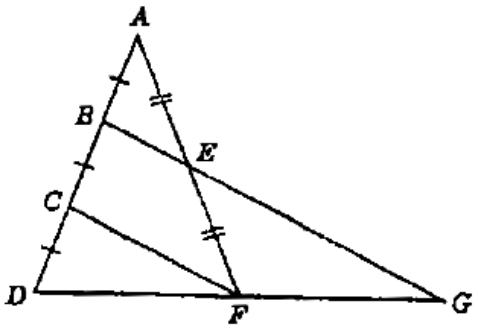
22. Refer to the figure below, in ΔADF, $AB = BC = CD$ and $AE = EF$. BE and DF are produced to meet at G. Find $BE : EG$.

A. 1 : 2

B. 1 : 3

C. 1 : 4

D. 2 : 3



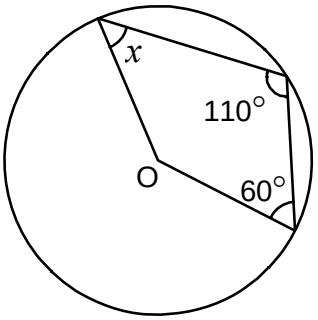
23. In the figure, O is the centre of the circle. Find x.

A. 80°

B. 70°

C. 60°

D. 50°



24. $\dfrac{\sin 90^\circ}{1+\cos(90^\circ+\theta)}+\dfrac{\tan 135^\circ}{1+\cos(270^\circ+\theta)}=$

A. 0.

B. $2\tan\theta$.

C. $\dfrac{2\sin\theta}{\cos^2\theta}$.

D. $\dfrac{2\cos\theta}{\sin^2\theta}$.

25. For $0^\circ \le \theta < 360^\circ$, how many roots does the equation $3\tan^2\theta - 8\tan\theta = 0$ have?

A. 2

B. 3

C. 4

D. 5

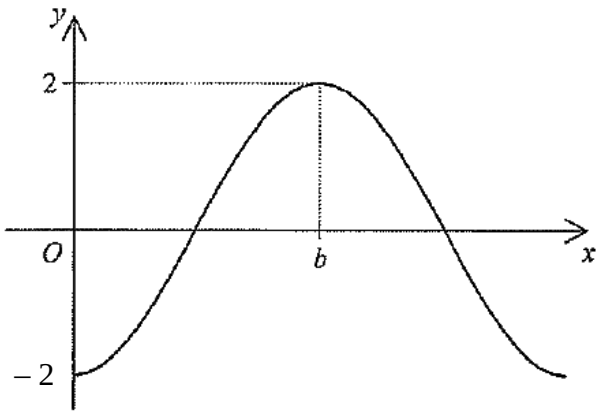
26. Let a and b be constants. If the figure shows the graph of $y = a\cos 2x^\circ$, then

A. $a = -2$ and $b = 90$.

B. $a = -2$ and $b = 360$.

C. $a = 2$ and $b = 90$.

D. $a = 2$ and $b = 360$.



27. Denote the circle $3x^2 + 3y^2 + 18x - 12y + 14 = 0$ by C. Which of the following is/are true?

I. The area of C is $\frac{25}{3}\pi$.

II. The point (0, 0) lies outside C.

III. The centre of C lies in the fourth quadrant.

A. II only

B. III only

C. I and II only

D. I and III only

28. Two fair dice are thrown in a game. If the sum of the two numbers thrown is 7, \$30 will be gained; otherwise, \$6 will be gained. Find the expected gain of the game.

A. \$10

B. \$11

C. \$12

D. \$13

29. Consider the following integers:

$$4 \quad 4 \quad 5 \quad 5 \quad 5 \quad 5 \quad 5 \quad 7 \quad 7 \quad 8 \quad 10 \quad 10 \quad 11 \quad 12 \quad m$$

Let p, q and r be the mean, the median and the mode of the above integers respectively.
If $5 \le m \le 7$, which of the following must be true?

I. $p > q$

II. $p > r$

III. $q > r$

A. I only

B. II only

C. I and II only

D. II and III only

30. $A(7, 1)$ and $B(5, 3)$ are two points in a rectangular coordinate plane. A point $P(x, y)$ moves such that $PA \perp PB$. The locus of P is

A. a circle with centre (6, 2), excluding points $A(7, 1)$ and $B(5, 3)$.

B. a parabola opening upwards with the mid-point of AB as the vertex.

C. the perpendicular bisector of AB.

D. a pair of parallel lines.

Section B

31. 101100001110_2 =

A. $11\times 2^8+14$.

B. $12\times 2^8+14$.

C. $11\times 2^9+14$.

D. $12\times 2^9+14$.

32. If $\left(1+\dfrac{3}{\log x}\right)(\log x-1)=4$, then $\log\dfrac{1}{x}$ =

A. -1 or 3.

B. 1 or -3.

C. $-\dfrac{1}{3}$ or 1.

D. $\dfrac{1}{3}$ or -1.

33. It is given that $\log_3 y$ is a linear function of $\log_{27} x$. The intercepts on the vertical axis and on the horizontal axis of the graph of the linear function are 5 and 2 respectively. Which of the following must be true?

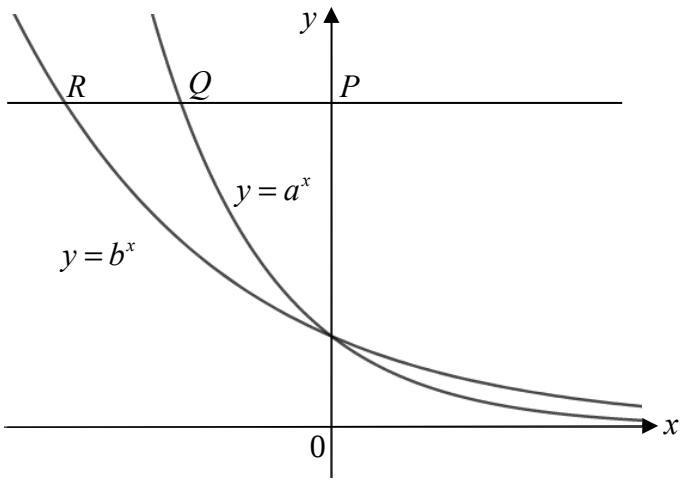
A. $xy^3=3^{24}$

B. $x^3y=3^{24}$

C. $x^5y^6=3^{30}$

D. $x^6y^5=3^{30}$

34.



The figure shows the graphs of $y = a^x$ and $y = b^x$ on the same rectangular coordinate plane, where *a* and *b* are positive constants. If a horizontal line cuts the *y*-axis, the graph of $y = a^x$ and the graph of $y = b^x$ at the points *P*, *Q* and *R* respectively, which of the following must be true?

I. $a > 1$

II. $ab < 1$

III. $\frac{QR}{PQ} = \log_b a - 1$

A. I only

B. II only

C. II and III only

D. I, II and III

35. If *a* is a real number, then the real part of $\frac{3+i^3}{a-i} - i^7$ is

A. $\frac{3a+1}{a^2-1}$.

B. $\frac{3a+1}{a^2+1}$.

C. $\frac{3a-1}{a^2+1}$.

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

36. Consider the following system of inequalities:

$$\begin{cases} 2x - y \geq 0 \\ x + 2y \geq 10 \\ 3x + y \leq 20 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. Find the constant k such that the greatest value of $x - 3y + k$ is 21, where (x, y) is a point lying in R.

A. 1.

B. 10.

C. 11.

D. 21.

37. Find the range of values of k such that the circle $x^2 + y^2 - 2x - 1 = 0$ and the straight line $x - y + k = 0$ intersect.

A. $-3 \leq k \leq 1$

B. $-1 \leq k \leq 3$

C. $k \leq -3$ or $k \geq 1$

D. $k \leq -1$ or $k \geq 3$

38. Jimmy walks from town A at a speed of 2 km/h in the direction N45°E. Mary walks from town B at a speed of 2.5 km/h in the direction Nθ°W. The distance between towns A and B is 9 km. After walking for 4 hours, they meet at town R. Find the value of θ correct to 3 significant figures.

A. 4.46^o

B. 13.8^o

C. 49.5^o

D. 58.8^o

39. $VABCD$ is a right pyramid with a square base $ABCD$ and V is the vertex.

$VA = VB = VC = VD = AB = 20$ cm. Find the angle between the planes VAB and $ABCD$.

A. 63.4° (cor. to 1 d.p.)

B. 60°

C. 54.7° (cor. to 1 d.p.)

D. 45°

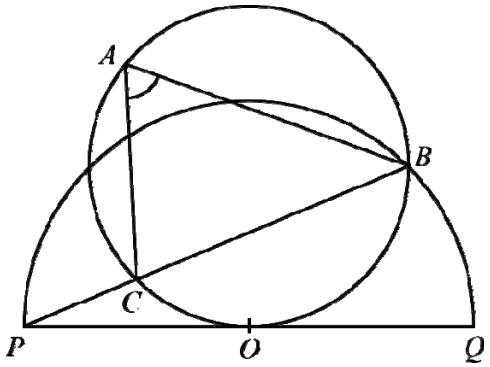
40. In the figure, PQ is the tangent to the circle ABC at O, where O is the centre of the semicircle PBQ. It is given that BCP is a straight line. If $\angle BPQ = 15^\circ$, then $\angle BAC =$

A. 30°.

B. 45°.

C. 60°.

D. 75°.



41. The equations of the three sides of a triangle are $5x + 12y + 108 = 0$, $5x - 12y - 108 = 0$ and $y = a$, where a is a constant. If the y-coordinate of the in-centre of the triangle is 17, then $a =$

A. 41.

B. 27.

C. 24.

D. – 7.

42. 4 children are going to drink 8 distinct bottles of milk. If each child drinks two bottles, in how many ways can they drink?

A. 70

B. 90

C. 2 520

D. 40 320

43. A number of customers are queueing in a customer service centre. If the probability that a customer in the queue is female is 0.8, find the probability that there are at least 3 female customers among the first 4 of the queue.

A. 0.1808
B. 0.4096
C. 0.512
D. 0.8192

44. In a test, the scores of the students follow the normal distribution with mean of 75 marks. It is known that the test score and standard score of a student are 90 marks and 3 respectively. Find the percentage of students who score more than 80 marks. (*Assume that in a normal distribution, 68%, 95% and 99.7% of the data lie within one, two and three standard deviations respectively from the mean.*)

A. 34%
B. 16%
C. 2.5%
D. 0.25%

45. It is given that T(n) is the nth term of an arithmetic sequence. Let x_1, y_1 and z_1 be the median, the inter-quartile range and the standard deviation of the group of numbers {T(1), T(2), T(3), …, T(25)} respectively while x_2, y_2 and z_2 be the median, the inter-quartile range and the standard deviation of the group of numbers {T(26), T(27), T(28), …, T(50)} respectively. Which of the following must be true?

I. $x_1 < x_2$
II. $y_1 = y_2$
III. $z_1 = z_2$

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

END OF PAPER