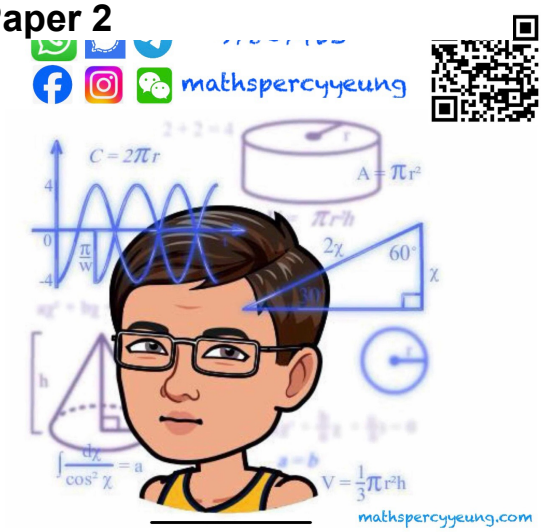


22-23-F.3
MATHS
PAPER 2

2022 - 2023 FINAL EXAMINATION

F.3 MATHEMATICS

Time Allowed: 1 hour 10 minutes

10:50 a.m. - 12:00 noon

Date : 23–6–2023 (Fri)

1. Read carefully the instructions on the Answer Sheet and insert the information required in the spaces provided.
2. When told to open this question 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 mark all your answers on the Answer Sheet.
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.
7. Mark your answers with a HB pencil. Marks will be deducted if the answers are not marked with a HB pencil.
8. The diagrams in this paper are not necessarily drawn to scale.

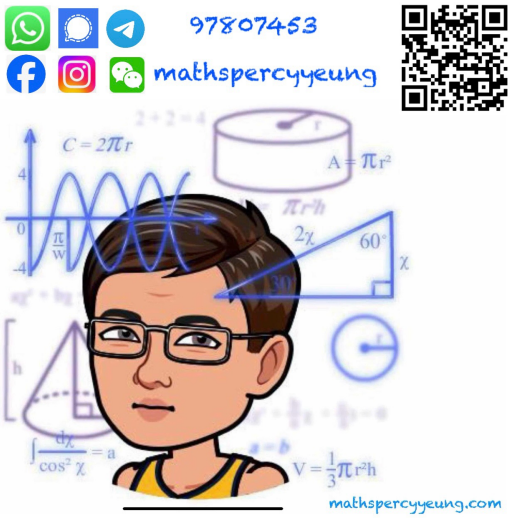
1. Which of the following is an identity?

A. $(x-3)^2 = x^2 - 9$

B. $x^2 = 9$

C. $(x+3)(3-x) = x^2 - 9$

D. $x^2 - 9 = -(9-x^2)$



2. $\left(-\frac{1}{16}\right)^{100} \times 2^{400} =$

A. 0

B. 1

C. 2^{300}

D. $\frac{1}{16}$

3. Simplify $\left(-\frac{1}{5}ab^2\right)^3$.

A. $\frac{1}{125}a^3b^6$

B. $-\frac{1}{125}a^3b^6$

C. $\frac{1}{15}a^4b^5$

D. $-\frac{1}{15}a^4b^5$

4. Which of the following expressions are NOT true?

I. $(-3)^0 = 3^0$

II. $(x^2)^{n+1} = x^{2n+1}$, where n is an integer and $x > 1$.

III. $3^a \times 5^b = 15^{a+b}$, where a, b are non-zero integers.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

5. Express $\frac{(8.4\times10^{-9})(6.9\times10^{14})}{4.2\times10^{12}}$ in scientific notation.

A. 1.38×10^{-6}

B. 13.8×10^{-7}

C. 1.38×10^{-8}

D. 0.138×10^{-9}

6. $10000001101_2 =$

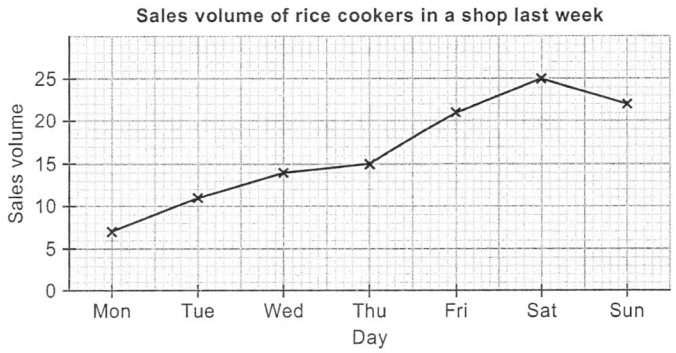
A. $2^9 + 45$

B. $2^{10} + 13$

C. $2^{10} + 90$

D. $2^{11} + 26$

7. The broken-line graph shows the sales volume of rice cookers in a shop last week.



Find the percentage change in the sales volume of rice cookers in the shop from Thursday to Friday.

A. +4%

B. +6%

C. +40%

D. +60%

8. If the base of a triangle increases by 20% and its height decreases by m%, its area will decrease by 4%. Find the value of m.

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

B. 20

C. 24

D. 80

9. Water is added to a swimming pool in a way that the volume of water inside the pool increases by 30% every half an hour. Find the percentage change in the volume of water inside the pool after 2 hours.

   A. +69 %

   B. +169%

   C. +185.61%

   D. +285.61%

10. The population of a city is 1 687 296 this year. If the population has increased by 4% every year, find the population of the city three years ago.

    A. 540800

    B. 1500000

    C. 1506514 (corr. to the nearest integer)

    D. 1897979 (corr. to the nearest integer)

11. A sum of $110 000 is deposited at an interest rate of 6% p.a. for 2 years, compounded monthly. Find the interest correct to the nearest dollar.

    A. $1103

    B. $13988

    C. $123988

    D. $335383

12. Factorize $a^2 - 2a - 8 + 2am + 4m$.

A. $(a-4)(a+2+m)$

B. $(a-4)(a+2+2m)$

C. $(a+2)(a-4+m)$

D. $(a+2)(a-4+2m)$

13. Factorize $2x^2 - 7xy - 30y^2$.

A. $(2x-15y)(x+2y)$

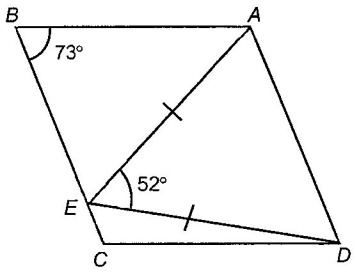
B. $(2x-5y)(x+6y)$

C. $(2x+15y)(x-2y)$

D. $(2x+5y)(x-6y)$

14. In the figure, $ABCD$ is a parallelogram. E is a point on BC such that $AE = DE$.

Find $\angle CDE$.



A. 9°

B. 11°

C. 19°

D. 21°

15. In the figure, $ABCD$ is a rhombus. The diagonals AC and BD intersect at E.

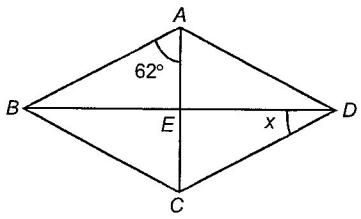
Find x.

A. 28°

B. 31°

C. 45°

D. 62°



16. Which of the following descriptions of quadrilaterals **MUST** be correct?

A. Any rhombus must be a rectangle.

B. Any rectangle must be a parallelogram.

C. All interior angles of any rhombus must be acute.

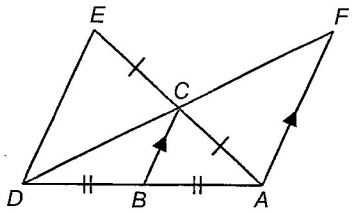
D. All sides of any parallelogram must be equal in length.

17. In the figure, ABD, ACE and DCF are straight lines. B and C are the mid-points of AD and AE respectively. It is given that $BC \parallel AF$. Which of the following must be true?

I. $DC = CF$

II. $AF \parallel DE$

III. $\angle CDE = \angle CAF$



A. I and II only

B. I and III only

C. II and III only

D. I, II and III

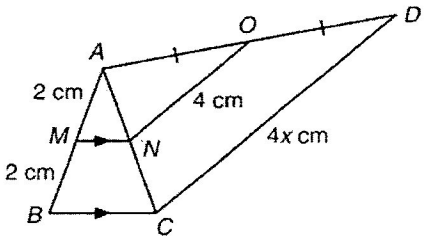
18. In the figure, AMB, ANC and AOD are straight lines. Find the value of x.

A. 1

B. 2

C. 3

D. 4

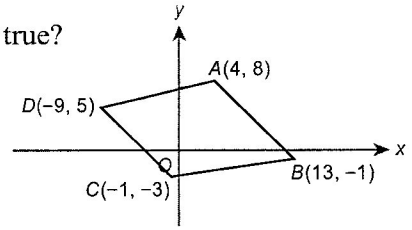


19. In the figure, the vertices of quadrilateral $ABCD$ are $A(4, 8)$, $B(13, -1)$, $C(-1, -3)$ and $D(-9, 5)$. Which of the following must be true?

I. $AD < BC$

II. $AB // DC$

III. $ABCD$ is a parallelogram.



A. I and II only

B. I and III only

C. II and III only

D. I, II and III

20. If the straight line passing through points $C(-8, 6)$ and $D(4, y)$ is perpendicular to the straight line with the slope of $\frac{3}{4}$, find the value of y.

A. -22

B. -10

C. 3

D. 5

21. Find the coordinates of the intersection of the x-axis and the straight line passing through points $R(3, 28)$ and $S(12, 52)$.

A. $(-36, 0)$

B. $\left(-\frac{27}{2}, 0\right)$

C. $\left(-\frac{15}{2}, 0\right)$

D. $(20, 0)$

22. If $M(a, a+1)$ is the mid-point of $A(-21, 4)$ and $B(9, b)$, then $b =$

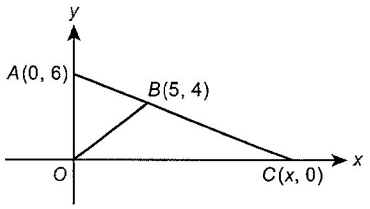
A. -6

B. -14

C. -16

D. -32

23. In the figure, three points $A(0, 6)$, $B(5, 4)$ and $C(x, 0)$ are collinear. Find the ratio of the area of ΔOAB to that of ΔOBC.



A. 1 : 2

B. 1 : 3

C. 2 : 1

D. 3 : 1

24. If $12\tan\frac{\theta}{2}-4\sqrt{3}=0$, then $\theta=$

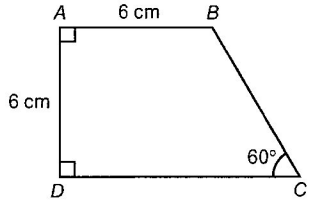
A. $30°$

B. $45°$

C. $60°$

D. $120°$

25. Find the perimeter of trapezium $ABCD$ in the figure.



A. $(21+4\sqrt{3})$ cm

B. $(30+2\sqrt{3})$ cm

C. 33 cm

D. $(18+6\sqrt{3})$ cm

26. $\dfrac{1}{\tan^2(90°-\theta)}+\dfrac{\sin^2\theta}{\sin^2(90°-\theta)}=$

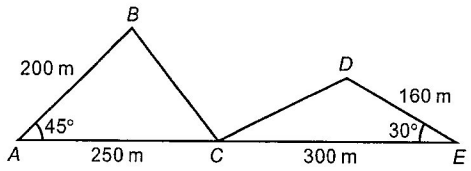
A. 1

B. 0

C. $2\cos^2\theta$

D. $2\tan^2\theta$

27. In the figure, AB, BC, CD and DE are four slopes. ACE is a horizontal line. Which of the following is true?



A. AB is the steepest.

B. BC is steeper than AB.

C. CD is steeper than DE.

D. DE is the least steep.

28. Find the gradient of a slope with an inclination of 5.2° in the form of $1:n$, where correct n to the nearest integer.

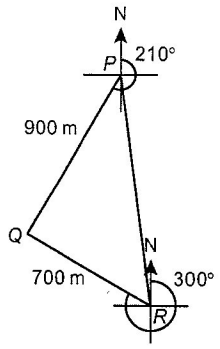
A. 1 : 1

B. 1 : 9

C. 1 : 11

D. 1 : 79

29. In the figure, the true bearings of point Q from point P and point R are 210° and 300° respectively. $PQ = 900$ m and $QR = 700$ m. Find the true bearing of P from R correct to the nearest degree.



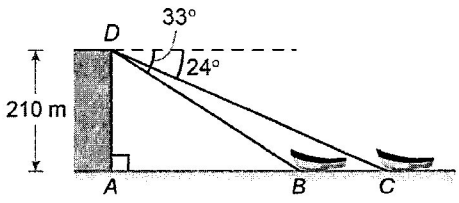
A. 171°

B. 172°

C. 351°

D. 352°

30. In the figure, the angles of depression of two boats B and C from the top D of a cliff are 33° and 24° respectively. D is 210 m above the sea level. Find the distance between the two boats correct to 3 significant figures.



A. 148 m

B. 200 m

C. 230 m

D. 368 m

31. Solve the inequality $\frac{x-8}{4} < \frac{-9-2x}{7}$.

A. $x < \frac{4}{3}$

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

C. $x < -\frac{4}{3}$

D. $x > -\frac{4}{3}$

32. If $mn > 0$, which of the following must be true?

I. $m+n>0$

II. $\frac{1}{mn} > 0$

III. $\frac{n}{m} > 0$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

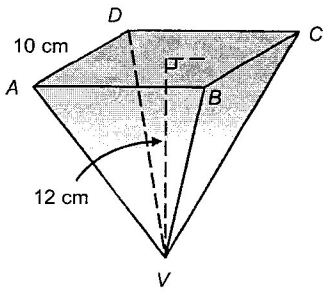
33. In the figure, *VABCD* is a container in the shape of an inverted right pyramid with a square base of side 10 cm. The height of the container is 12 cm. The container is fully filled with water. Find the area of the wet surface of the container.

A. 130 cm^2

B. 230 cm^2

C. 260 cm^2

D. 360 cm^2



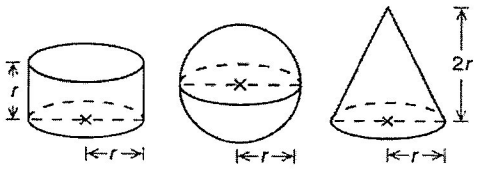
34. The figure shows a cylinder, a sphere and a right circular cone. Find the ratio of their volumes.

A. 3 : 4 : 6

B. 4 : 3 : 2

C. 4 : 3 : 6

D. 3 : 4 : 2



35. The ratio of the base areas of two similar prisms is 9 : 49. Which of the following is the ratio of their corresponding heights?

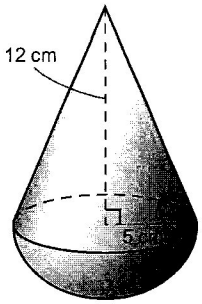
A. 3 : 7

B. $3^2 : 7^2$

C. $3^3 : 7^3$

D. $9^2 : 49^2$

36. The figure shows a solid formed by a right circular cone and a hemisphere with a common base. The radius of the hemisphere is 5 cm and the height of the circular cone is 12 cm. Find the total surface area of the solid.



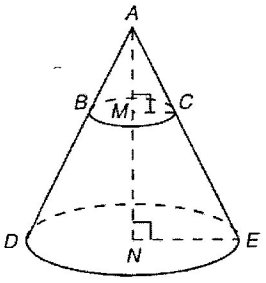
A. $115\pi \text{ cm}^2$

B. $150\pi \text{ cm}^2$

C. $165\pi \text{ cm}^2$

D. $174\pi \text{ cm}^2$

37. The figure shows two similar right circular cones ABC and ADE. If $AM : MN = 2 : 3$, find the ratio of the volume of cone ABC to that of frustum $BDEC$.



A. 8 : 27

B. 8 : 35

C. 8 : 117

D. 8 : 125

38. Each of bag A and bag B contains 1 red ball and 2 blue balls. A ball is drawn at random from each bag. Find the probability that the two balls drawn are of the same colour.

A. $\frac{4}{9}$

B. $\frac{5}{9}$

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

D. $\frac{4}{5}$

39. In throwing two fair dice, find the probability that the difference of the numbers is greater than 2.

A. $\frac{2}{9}$

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

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

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

40. A box contains 1 golden ball, 7 silver balls and 12 bronze balls. In a lucky draw, a ball is randomly drawn from the box and a certain number of tokens will be got according to the following table:

Colour of the ball drawn	Gold	Silver	Bronze
Number of tokens got	100	20	10

Find the expected number of tokens got in the lucky drawn.

A. 18

B. 19

C. 20

D. 21

41. The following table shows the training time of 20 members in a fitness centre last week.

Training time (h)	1 – 5	6 – 10	11 – 15	16 – 20
Number of members	4	8	5	3

Find the mean training time of these members last week.

A. 9 h

B. 9.25 h

C. 9.5 h

D. 9.75 h

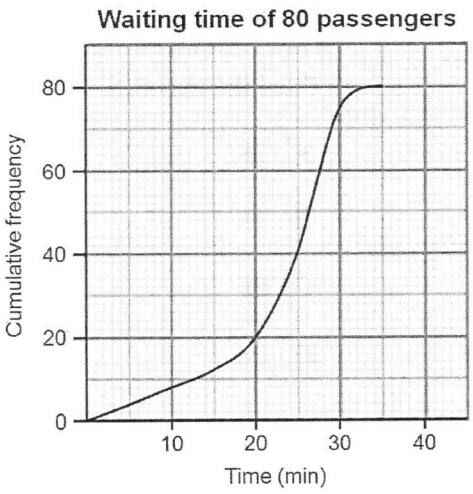
42. The cumulative frequency curve shows the waiting time of 80 passengers at a mini-bus stop. Find the median waiting time of these 80 passengers.

A. 16 min

B. 20 min

C. 25 min

D. 30 min



43. Consider a set of 13 integers 3, 3, 4, 4, 4, 4, 6, 8, 8, 9, 9, 10, x. Let p, q and r be the mean, the median and the mode of the above integers respectively. If $4 \le x \le 6$, 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 III only

D. II and III only

44. If the mean of a, b, c, d and e is m, what is the mean of $10a - 3$, $10b - 3$, $10c - 3$, $10d - 3$ and $10e - 3$?

A. m

B. $10m$

C. $10m - 3$

D. cannot be determined

45. The following table shows the marks of Amy and Billy in different papers of an English examination.

	Comprehension	**Composition**	**Oral**
Amy	65	70	60
Billy	67	60	62
Weight	50%	30%	20%

Which of the following is/ are true?

I. Amy has a higher mean mark than Billy has.

II. Amy has a higher weighted mean mark than Billy has.

III. Amy's weighted mean mark is higher than her mean mark.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

46. The following table shows the test marks of Sandy in 5 tests.

Marks	59	64	69	74	80
Weight	0.3	x	0.3	0.2	0.1

If the weighted mean mark of Sandy in these 5 tests is 67, find the value of x.

A. 0.1

B. 0.2

C. 0.3

D. 0.4

- End of Paper -