Maryknoll Convent School
(Secondary Section)
Form 6 Mock Examination February 2020
Mathematics Compulsory Part
Paper 2

Time allowed: $1\frac{1}{4}$ hours

Name: _____( )
Form 6 _____

INSTRUCTIONS

1. Read the instructions on the Answer Sheet carefully and enter 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

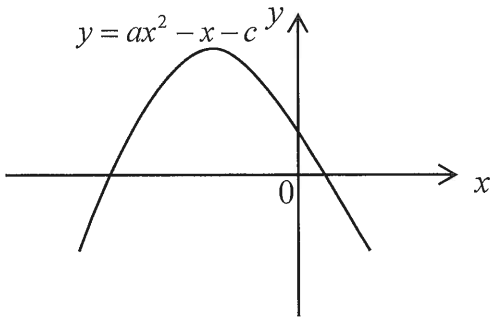
1. $0.0259198 =$
   A. 0.02 (correct to 2 decimal places).
   B. 0.026 (correct to 3 significant figures).
   C. 0.0259 (correct to 4 decimal places).
   D. 0.02592 (correct to 5 significant figures).

2. $\left(\frac{a^{2a}a^2}{2a}\right)^3 =$
   A. $\frac{a^{18a}}{8}$.
   B. $\frac{a^{3+6a}}{8}$.
   C. $\frac{a^{6a+5}}{8}$.
   D. $8a^{6a+3}$.

3. Let a_n be the n^{th} term of a sequence. If $a_3 = 10$, $a_6 = 44$ and $a_n = a_{n+1} - a_{n-1}$ for any positive integer n, where $n \geq 2$, then $a_1 =$
   A. 3.
   B. 7.
   C. 10.
   D. 17.

4. The solution of $x - \frac{x-1}{2} \leq 2 - \frac{2x-1}{6}$ or $4x - 5 > 7 - 2x$ is
   A. $x = 2$.
   B. all real numbers except $x = 2$.
   C. all real numbers.
   D. no solutions.

5. The figure shows the graph of $y = ax^2 - x - c$, where a and c are constants. Which of the following is/are true?
   I. $a < 0$
   II. $c > 0$
   III. $ac > -\frac{1}{4}$
   A. I only
   B. I and II only
   C. I and III only
   D. II and III only



6. $(a+b)^2-4(a-b)^2=$

A. $-3a^2+5b^2$.

B. $-3(5a^2-6ab+5b^2)$.

C. $(3a-b)(a+3b)$.

D. $(3a-b)(3b-a)$.

7. If h and k are positive constants such that $(x-h)^2+k(x-1)\equiv x(x+h)-k+1$, then $k=$

A. 1.

B. 2.

C. 3.

D. 4.

8. If $\dfrac{\alpha}{x\beta}+\alpha=\dfrac{1}{\beta}$, then $\beta=$

A. $\dfrac{1}{\alpha(1-x)}$.

B. $\dfrac{1-\alpha}{\alpha(1-x)}$.

C. $\dfrac{x-\alpha}{x\alpha}$.

D. $-\dfrac{x+\alpha}{x\alpha}$.

9. If $15t+24s=27=2t+5s$, then $s-t=$

A. -32.

B. 6.

C. 19.

D. 32.

10. If $2x=3y=4z$, then $(x+y):(y+z)=$

A. 5 : 7.

B. 7 : 5.

C. 7 : 10.

D. 10 : 7.

11. One part of a is a constant and the other part varies directly as b^2. When $a=17$, $b=2$, and when $a=42$, $b=3$. When b is increased by 20% from the value of 3, then, correct to 3 significant figures, a increases by

A. 61.4%.

B. 47.1%.

C. 38.1%.

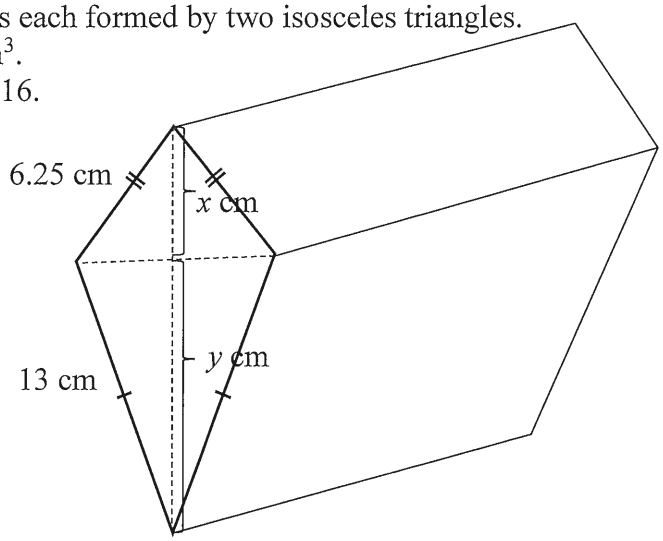
D. 32.0%.

12. If $h(x) = 2x^3 + 5x^2 - 7x + 2$ is divisible by $x^2 + 3x + k$, then $k =$
    A. -1.
    B. -2.
    C. 1.
    D. 2.

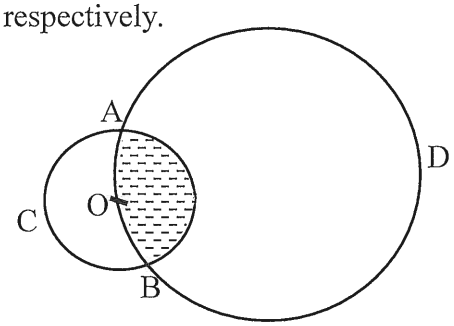
13. A sum of \$127 000 is deposited at an interest rate of 3% per annum for 5 years, compounded monthly. Find the interest correct to the nearest ten dollars.
    A. \$20220
    B. \$20230
    C. \$20520
    D. \$20530

14. The figure shows a solid right prism with the bases each formed by two isosceles triangles. It is given that the volume of the prism is 1575 cm^3.
    Find the total surface area of the prism if $x : y = 5:16$.

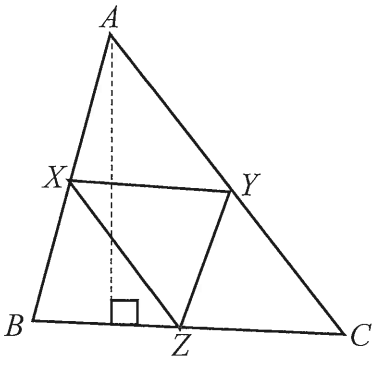
    A. 927.5 cm^2
    B. 848.75 cm^2
    C. 787.5 cm^2
    D. 750.75 cm^2



15. In the figure, ABC and ABD are circles with radii 1 cm and 3 cm respectively. Circle ABD passes through O which is the centre of circle ABC.
    Find the area of the shaded region correct to 3 significant figures.
    A. 1.43 cm^2
    B 1.44 cm^2
    C. 1.45 cm^2
    D. 1.46 cm^2

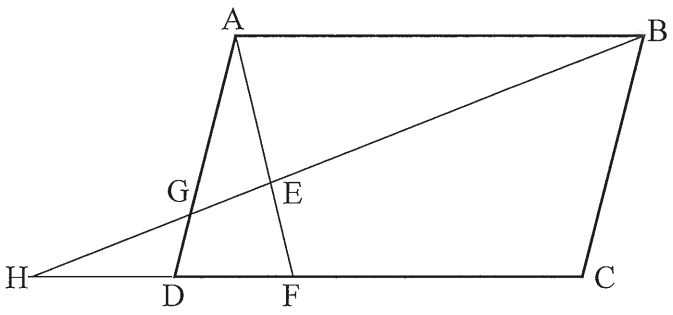


16. In $\triangle ABC$, X, Y and Z are mid-points of AB, AC and BC respectively. It is given that $\angle YXZ = a$ and $\angle XYZ = b$. $AC =$
    A. $\dfrac{AB\sin b}{\cos a}$.
    B. $\dfrac{AB\sin b}{\sin a}$.
    C. $\dfrac{AB\cos b}{\sin a}$.
    D. $AB\sin b\sin a$.



17. ABCD is a parallelogram. G and F are points on AD and DC respectively. BG and AF intersect at E, where AE:EF = 3:2 and DF:FC = 1:2. BG produced and CD produced intersect at H. Given that the area of the quadrilateral DFEG = 22, find the area of $\triangle ABE$.

A. 30
B. 54
C. 72
D. 90



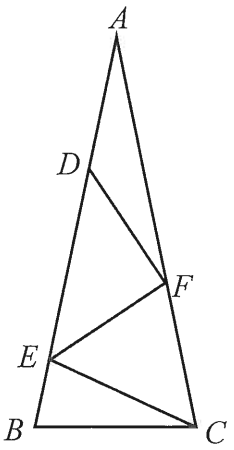
18. $\dfrac{\sin 150°}{1-\sin(90°-\theta)}+\dfrac{\cos 240°}{1-\sin(270°+\theta)}=$

A. 0.
B. $\dfrac{\sin\theta}{\tan\theta}$.
C. $\dfrac{1}{\sin\theta\tan\theta}$.
D. $\dfrac{\cos\theta}{\tan\theta}$.

19. In the figure, ABC is an isosceles triangle with $AB = AC$. D and E are points on AB while F is a point on AC such that $BC = CE = EF = FD$. If $\angle BAC = 20°$, which of the following is/are true?

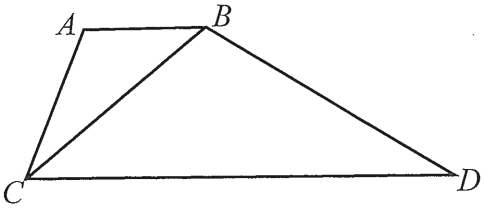
I. ΔCEF is equilateral
II. $\Delta ADF \sim \Delta EFD$
III. $AD = BC$

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



20. In the figure, AB // CD, $\angle CAB = \angle DBC$, $AB = 3$ cm and $CD = 12$ cm. Find BC.

A. 2 cm
B. 4 cm
C. 6 cm
D. 8 cm



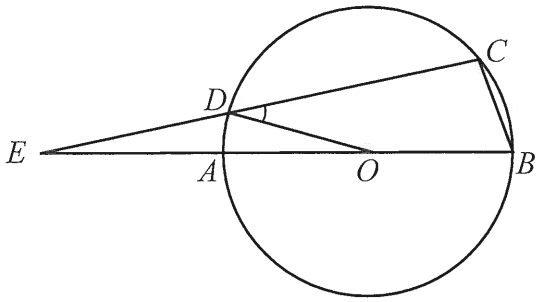
21. The sum of the interior angles of a regular n-sided polygon is 2340°. Which of the following are true?

I. The value of n is 15.
II. Each exterior angle of the polygon is 24°.
III. There are 15 lines of reflectional symmetry.

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

22. In the figure, O is the centre of the circle $ABCD$. $EAOB$ and EDC are straight lines. $\angle BCD = 104°$ and $\angle AED = 20°$. Find $\angle CDO$.

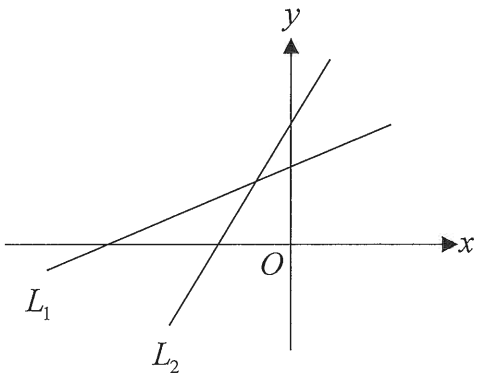
A. 34°
B. 40°
C. 44°
D. 48°



23. In the figure, the equations of the straight lines L_1 and L_2 are $5x+ay=b$ and $cx+y=d$ respectively. Which of the following is/are true?

I. $ac<5$
II. $ad<b$
III. $bc<5d$

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



24. The coordinates of the point F are $(0, a)$ and the equation of the line L is $y = -10$. Let P be a moving point in the rectangular coordinate plane such that the perpendicular distance from P to L is equal to the distance from P to F. If the locus of P passes through the point $(4,-5)$, find a.

A. -2 or -8
B. -2 or 0
C. ± 2
D. ± 8

25. The polar coordinates of the points P, Q and R are $(3,150°)$, $(6,300°)$ and $(4,330°)$ respectively. The perpendicular distance from Q to PR is

A. 2.
B. 3.
C. $2\sqrt{3}$.
D. $3\sqrt{3}$.

26. The equation of the circle C is $3x^2+3y^2-6x+24y+32=0$. Which of the following is/are true?

I. The radius of C is 11.

II. The point $(0,-8)$ lies outside C.

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

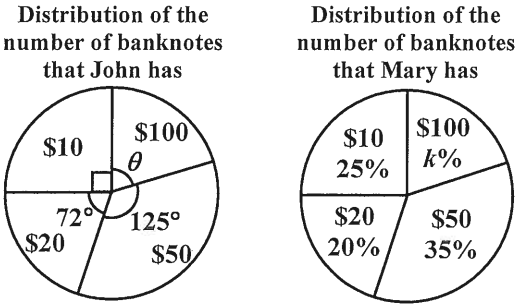
A. I only
B. II only
C. I and III only
D. II and III only

27. There are one \$10 coin, two \$5 coins and one \$2 coin in a pocket. If two coins are chosen at random from the pocket, find the probability that the total value of the two chosen coins is not less than \$10.

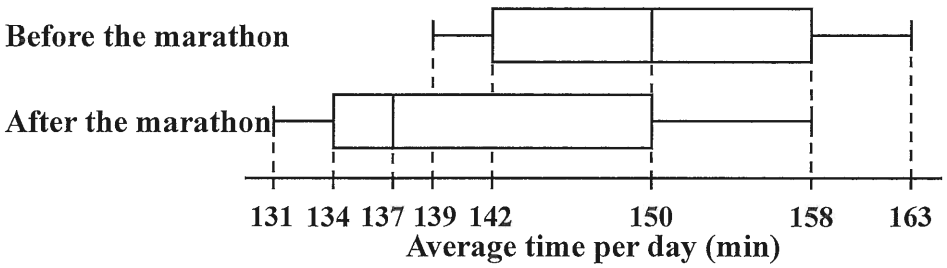
A. $\frac{1}{4}$
B. $\frac{2}{3}$
C. $\frac{3}{4}$
D. $\frac{7}{12}$

28. The pie charts show the distributions of the numbers of banknotes of different face values that John and Mary have. Which of the following must be true?

A. John has more \$50 banknotes than Mary.
B. John and Mary have the same number of \$20 banknotes.
C. $k=10$
D. $\theta=73°$



29.



The box-and-whisker diagrams show the average time per day (in min) spent by a group of athletes on running before and after the marathon. Which of the following must be true?

I. The range of the average time per day spent by the athletes on running before the marathon is smaller than that after the marathon.

II. The inter-quartile range of the average time per day spent by the athletes on running before the marathon is the same as that after the marathon.

III. At least 75% of the athletes spend less time on average per day on running after the marathon.

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

30. Consider the following integers:

2 2 3 4 4 5 8 8 8 8 9 12 m

Let a, b and c be the mean, the mode and the median of the above integers respectively. If $5 \le m \le 8$, which of the following must be true?

I. $a < b$

II. $a > c$

III. $b > c$

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

Section B

31. If $\dfrac{1}{\log x - 1} - 1 = \dfrac{4(\log x) - 17}{11(\log x) + 5}$, then $\log \dfrac{1}{x^2} =$

A. $-\dfrac{3}{14}$ or $\dfrac{5}{2}$.

B. $-\dfrac{3}{14}$ or $-\dfrac{5}{2}$.

C. $-\dfrac{14}{3}$ or $\dfrac{2}{5}$.

D. $-\dfrac{14}{3}$ or $-\dfrac{2}{5}$.

32. $2^{10} - 2^7 + 5 \times 2^7 - 2^3 + 3 \times 2^2 + 2 =$

A. 1011100111_2.
B. 1111001110_2.
C. 11000000110_2.
D. 100111001110_2.

33. Let a_n be the n^{th} term of a geometric sequence with common ratio r. Given that $a_2 > 0$ and the sum to infinity of the sequence is -3, which of the following are true?

I. $-1 < r < 0$

II. $-6 < a_1 < -3$

III. If k is a positive integer, then $a_1 + a_2 + \cdots + a_{2k-1} + a_{2k} > -3$.

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

34. It is given that $\sqrt[3]{y}$ is a linear function of x. The intercepts on the vertical axis and on the horizontal axis of the graph of the linear function are 2 and 1 respectively. Which of the following must be true?

A. $y = x^3 - 3x^2 + 3x - 1$

B. $y = 8x^3 - 24x^2 + 24x - 8$

C. $y = -8x^3 + 12x^2 - 6x + 1$

D. $y = -8x^3 + 24x^2 - 24x + 8$

35. Consider the following system of inequalities:

$$\begin{cases} 2x + y \geq 5 \\ 4x + y \leq 41 \\ x - 2y + 10 \geq 0 \\ y \geq 1 \end{cases}$$

Let D be the region which represents the solution of the above system of inequalities. If (x, y) is a point lying in D, then the least value of $75 - 4x - 3y$ is

A. 16.

B. 18.

C. 22.

D. 64.

36. If $a \neq b$ and $\begin{cases} 3a^2 - 2c = 6a \\ 3b^2 - 2c = 6b \end{cases}$, where c is a constant, find $a^3 + b^3$ in terms of c.

A. $8 + 4c$

B. $8 + \frac{4}{3}c$

C. $-\frac{8}{3}c^2 - \frac{8}{3}c$

D. $-\frac{8}{27}c^3 + 4c$

37. If k is a real number, the real part of $\frac{i^{23} + i^{24}}{i + k} - ki^{22}$ is

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

B. $\frac{k+1}{k^2+1}$.

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

D. $\frac{k^3 + 2k + 1}{k^2 + 1}$.

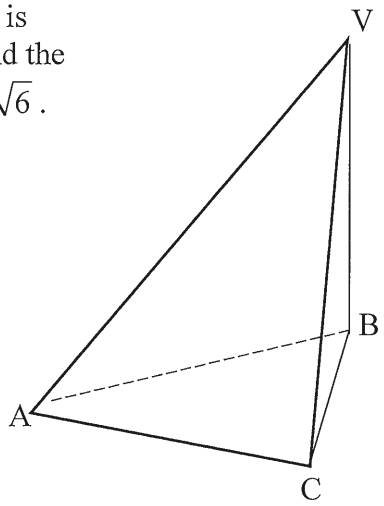
38. The figure shows a tetrahedron VABC. V is vertically above B. It is given that $\angle VAB = 45°$, $\angle VCB = 60°$ and $\angle ABC = 135°$. Find the distance of V to plane ABC if the volume of the tetrahedron is $48\sqrt{6}$.

A. $12\sqrt{3}$

B. $12\sqrt{6}$

C. $18\sqrt{3}$

D. 12



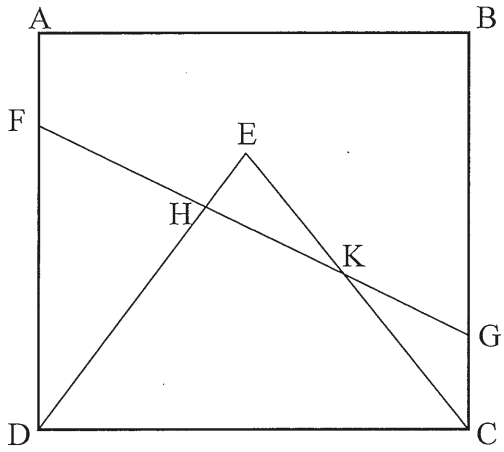
39. In the figure, ABCD is a square and $\triangle CDE$ is an equilateral triangle. F and G are points on AD and BC respectively. It is given that AF = 2 cm, GC = 3 cm and AB =10 cm. FG intersects DE and CE at H and K respectively. Find HK correct to 3 significant figures.

A. 4.21 cm

B. 4.45 cm

C. 5.15 cm

D. 5.79 cm



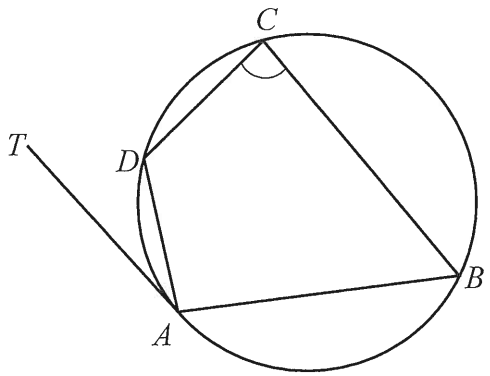
40. In the figure, *TA* is a tangent to the circle *ABCD* at the point *A*. It is given that *TA* // *CB*, *AD* = *CD* and $\angle TAB = 118°$. Find $\angle BCD$.

A. 87°

B. 90°

C. 93°

D. 96°



41. It is given that a is a positive constant. The straight line $4x+3y=a$ cuts the x-axis and the y-axis at points P and Q respectively. Let R be a point lying on the y-axis such that the x-coordinate of the orthocentre of ΔPQR is 12. Find the y-coordinate of R.

A. −16

B. −9

C. 9

D. 16

42. Five different white balls and two different red balls are arranged in a row. If no red balls are next to each other, in how many ways can the balls be arranged?

A. 240
B. 1440
C. 3600
D. 4320

43. Peter, John and Mary try to solve the same problem independently. The probability that at least one of them can solve the problem is 0.976. The probability that Peter can solve the problem is 0.8 and the probability that John can solve the problem is 0.7. Find the probability that exactly one of the three persons (Peter, John and Mary) can solve the problem.

A. 0.488
B. 0.452
C. 0.252
D. 0.188

44. In a Chemistry test, the passing score is 50 and the mean of the scores of the students is 57. The scores of Chris and Justin are 45 and 78 respectively. The standard score of Justin is 3. Which of the following must be true?

I. The standard deviation of the scores is 7.
II. The standard score of Chris is greater than –2.
III. A student with a negative standard score must fail the test.

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

45. It is given that $a_1, a_2, a_3, ..., a_{100}$ is an arithmetic sequence with common difference 2. If the variance of $a_1, a_2, a_3, ..., a_{10}$ is 33, then the variance of $2a_{91}, 2a_{92}, 2a_{93}, ..., 2a_{100}$ is

A. 66.
B. 132.
C. 426.
D. 492.

END OF PAPER