ST. PAUL'S COLLEGE
FORM 6 INTERNAL EXAMINATION 2023 - 2024

MATHEMATICS Compulsory Part
PAPER 2

1¼ hours

Name				
Class				( )
Group	G1 LMW	G2 PSK	G3 TMF	G4 WHP
	G5 TMF	G6 LMW	G7 PSK	

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet. Write down the subject, your name, class and class number in the spaces provided and mark the corresponding boxes with an HB pencil.
2. Write your group number on the top right corner of the answer sheet.
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. 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.

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. If $\frac{u+v}{2u+v}=\frac{1}{v-2}$, then u =

   A. $\frac{v^2-3v}{4-v}$.

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

   C. $\frac{3v-v^2}{4-v}$.

   D. $\frac{v^2-v}{4-v}$.

2. $\frac{2}{2+3x}-\frac{5}{2-3x}=$

   A. $\frac{6+21x}{9x^2-4}$.

   B. $\frac{6-21x}{9x^2-4}$.

   C. $\frac{6+9x}{9x^2-4}$.

   D. $\frac{6-9x}{9x^2-4}$.

3. $2^{2n+2}\,9^{n+1}=$

   A. 18^{3n+3}.

   B. 36^{n+1}.

   C. 36^{2n+2}.

   D. 6^{4n+4}.

4. $2m^2-3mn+n^2-m+n=$

   A. $(2m-n-1)(m-n)$.

   B. $(2m-n+1)(m-n)$.

   C. $(2m-n-1)(m+n)$.

   D. $(2m+n-1)(m+n)$.

5. If a and b are constants such that $(x+a)(x+1)+7\equiv x(x-b)+3$, then b =

A. -4 .
B. -3 .
C. 3 .
D. 4 .

6. The solution of $x + 3 > -1$ or $\frac{1-x}{3} < 2$ is

A. $x > -4$.
B. $x > -5$.
C. $x < -4$.
D. $x < -5$.

7. If $x = 3.44$ (correct to 3 significant figure), find the range of value of x.

A. $3.44 \leq x < 3.45$
B. $3.44 < x \leq 3.45$
C. $3.435 \leq x < 3.445$
D. $3.435 < x \leq 3.445$

8. Let $f(x) = 4 - x - x^2$. If k is a constant, then $f(k - 1) =$

A. $f(k)$
B. $f(-k)$
C. $f(1 + k)$
D. $f(1 - k)$

9. Let $g(x) = x^4 + px + q$, where p and q are constants. When $g(x)$ is divided $x - 1$, the remainder is 4. If $g(x)$ is divisible by $(x + 1)$, find the remainder when $g(x)$ is divided by $x - 3$.

A. 46
B. 56
C. 86
D. 88

10. Which of the following statements about the graph of $y = 2(3 - x)^2 - 6$ is true?

A. The graph opens downwards.
B. The graph passes through the origin $O(0, 0)$.
C. The y-intercept of the graph is -6.
D. The vertex of the graph is $(3, -6)$.

11. The marked price of a camera is \$2 000. A profit of 50% is made by selling the camera at a

discount of 25%. Find the cost of the camera.

A. \$750
B. \$1 000
C. \$1 250
D. \$1 500

12. The actual area of a park is 5km^2. If the area of the park on a map is 20cm^2, then the scale of the map is

A. 1 : 5 000 .
B. 1 : 25 000 .
C. 1 : 50 000 .
D. 1 : 2 500 000 .

13. It is given that x varies as the square root of y and cube of z. When $y = 4$ and $z = 1$, $x = 6$. When $y = 9$ and $z = 2$, $x =$

A. 24 .
B. 36 .
C. 72 .
D. 144 .

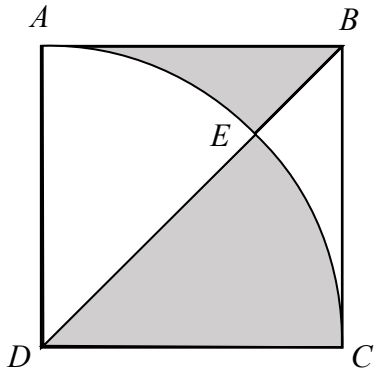
14. Let a_n be the nth term of a sequence. If $a_4 = 15$, $a_5 = 29$ and $a_{n+2} = a_{n+1} + 2a_n$ for any positive integer n, then $a_2 =$

A. 1 .
B. 2 .
C. 4 .
D. 7 .

15. The radius of a sphere and the radius of the base of a right circular cone are both r cm. If the surface area of the sphere is equal to the total surface area of the right circular cone, then the height of the right circular cone is

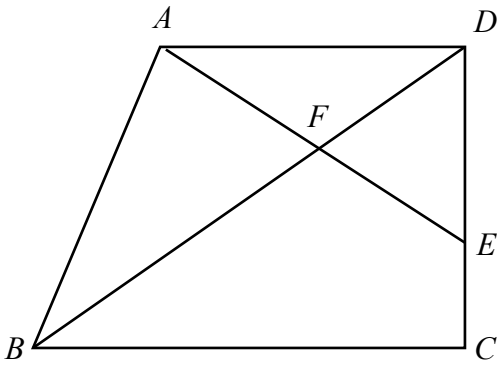
A. $2r$ cm .
B. $\sqrt{8}r$ cm .
C. $3r$ cm .
D. $\sqrt{10}r$ cm .

16. In the figure, $ABCD$ is a square. D is the centre of the arc AEC. If $AB = 10$ cm, the area of the shaded region is



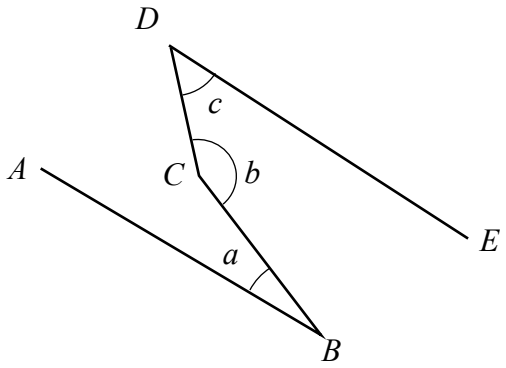
A. $25\ \text{cm}^2$.
B. $50\ \text{cm}^2$.
C. $75\ \text{cm}^2$.
D. $100\ \text{cm}^2$.

17. In the figure, $ABCD$ is a trapezium with $AD//BC$. Let E be a point on DC. Denote the point of intersection of AE and BD by F. It is given that AD: $BC = 2 : 3$ and $DE = 2EC$. If the area of the $\Delta DEF = 6\ \text{cm}^2$, then the area of the quadrilateral $BCEF$ is



A. $15\ \text{cm}^2$.
B. $18\ \text{cm}^2$.
C. $21\ \text{cm}^2$.
D. $27\ \text{cm}^2$.

18. In the figure, AB // DE. Which of the following must be true?



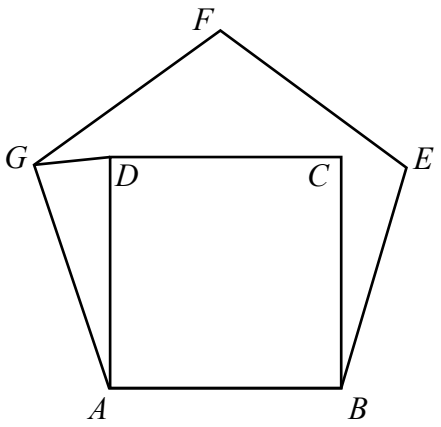
A. $a + b + c = 180^\circ$.
B. $a + 180^\circ = b + c$.
C. $b + 180^\circ = a + c$.
D. $c + 180^\circ = a + b$.

19. It is given that $ABCD$ is a trapezium with $AB//DC$. Let E be the points of intersection of the diagonals AC and BD. If $AC = BD$, which of the following must be true?

I. $\Delta ABE \sim \Delta CDE$.
II. $AE : EC = BE : ED$.
III. $\Delta BCE \cong \Delta ADE$.

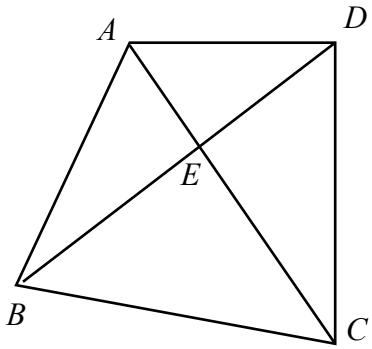
A. I only
B. II only
C. I and II only
D. I, II and III only

20. The figure shows the square $ABCD$ and the regular pentagon $ABEFG$. Find $\angle FGD$.



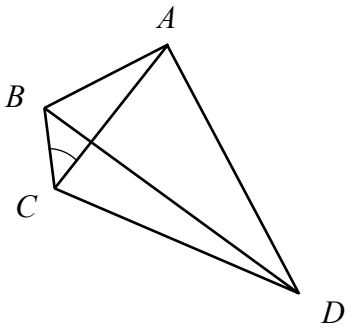
A. 24°
B. 27°
C. 30°
D. 32°

21. In the figure, $ABCD$ is a quadrilateral. Let E be the point of intersection of the diagonals AC and BD. If $\angle BAE = \angle EAD$ and $\angle ADE = \angle ACB$, which of the following must be true?



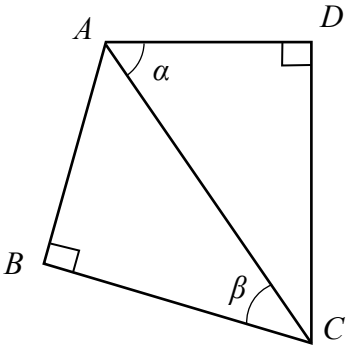
A. $\angle BCA = \angle ACD$
B. $\triangle BCE \cong \triangle DCE$
C. $BC^2 = AC \times EC$
D. $AC \perp BD$

22. In the figure, $ABCD$ is a cyclic quadrilateral. If $\angle BAC = 34^o$, $\angle CBD = 42^o$ and $AD = CD$, then $\angle ACB =$



A. 48^o .
B. 52^o .
C. 55^o .
D. 62^o .

23. In the figure, $\angle ABC = \angle ADC = 90^o$. Find $\dfrac{AD}{AB}$.



A. $\dfrac{\cos\alpha}{\sin\beta}$
B. $\cos\alpha \sin\beta$
C. $\dfrac{\sin\beta}{\cos\alpha}$
D. $\dfrac{1}{\cos\alpha \sin\beta}$

24. The rectangular coordinates of the point P are $(-3, 4)$. If P is translated to the right 5 units to Q and Q is rotated 90^0 clockwisely about the origin O to R, then the coordinates of R are

A. $(4, 8)$.
B. $(-4, 2)$.
C. $(2, -4)$.
D. $(4, -2)$.

25. Find the constant k such that the straight lines $3x - ky - 2 = 0$ and $(k + 2)x + 4y + k = 0$ are perpendicular to each other.

A. 1
B. 2
C. 4
D. 6

26. Let $A(4, 4)$ and $B(2, -6)$ be points in the rectangular coordinate plane. Let P be a moving point such that $BA = PB$. Then the locus of P is

A. a straight line.
B. a circle.
C. a pair of straight line.
D. a parabola.

27. The equation of the circles C_1 and C_2 are $x^2 + y^2 - 4x + 2y + 4 = 0$ and $2x^2 + 2y^2 - 12x + 4y + 9 = 0$ respectively. Let G_1 and G_2 be the centres of C_1 and C_2 respectively. Which of the following must be true?

I. G_1 lies inside C_2.
II. $G_2 = (6, -2)$.
III. C_1 lies inside C_2.

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

28. Two fair die are rolled. Find the probability that the product of the number is a multiple of 6.

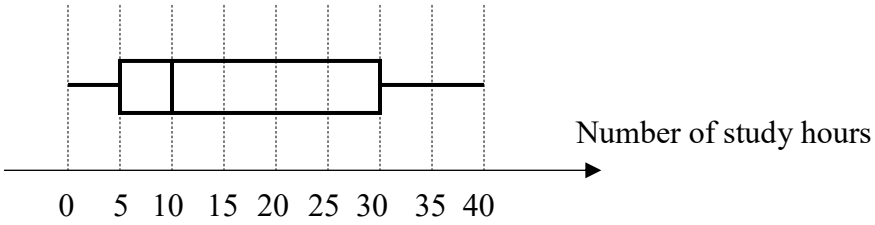
A. $\frac{1}{4}$

B. $\frac{13}{36}$

C. $\frac{5}{12}$

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

29. The box-and-whisker diagram below shows the distribution of number of study hours of some students in a week. Find the inter-quartile range of the distribution.



A. 20
B. 25
C. 30
D. 40

30. There are 12 boys and 15 girls in a class. The mean height of the boys is 120 cm and the mean height of the girls is 129 cm. Find the mean height of the students in this class.

A. 122 cm
B. 124 cm
C. 125 cm
D. 127 cm

Section B

31. $AB000000CD_{16}$ =

A. $171 \times 16^8 + 205$.
B. $171 \times 16^9 + 205$.
C. $188 \times 16^8 + 222$.
D. $188 \times 16^9 + 222$.

32. The L.C.M. of a^3b^2c, ab^2c^2 and a^2bc^3 is

A. abc .
B. $a^3b^2c^2$.
C. $a^3b^2c^3$.
D. $a^6b^5c^6$.

33. It is given that $\log_3 y$ is a linear function of $\log_9 x$. The intercepts on the vertical axis and the horizontal axis of the graph of the linear function are 4 and 3 respectively. Which of the following must be true?

A. $x^2y^3 = 27^2$
B. $x^4y^3 = 27^4$
C. $x^2y^6 = 27^4$
D. $x^2y^3 = 27^4$

34. If b is a real number, then the real part of $\dfrac{2-i}{b+i} + i^3$ is

A. $\dfrac{2b+1}{b^2+1}$.
B. $\dfrac{2b+1}{b^2-1}$.
C. $\dfrac{2b-1}{b^2+1}$.
D. $\dfrac{2b-b^2}{b^2+1}$.

35. Let $f(x) = x^2 + 2mx + 3m^2$, where m is real constant. Which of the following statements about the graph $y = f(-2x)$ must be true?

I. The x-coordinate of the vertex is $2m$.
II. The y-coordinate of the vertex is $2m^2$.
III. The equation of the axis of symmetry is $2x - m = 0$.

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

36. Let $T(n)$ be the nth term of a geometric sequence. If $T(4) + T(5) = 4$ and $T(6) = 9$, then $T(7) =$

A. 3.
B. $-\frac{27}{4}$.
C. 27.
D. 27 or $-\frac{27}{4}$.

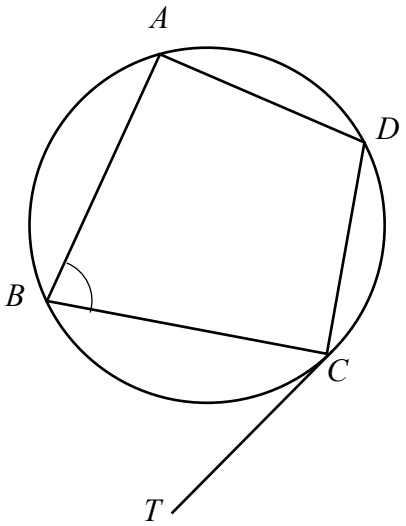
37. Consider the following system of inequalities.

$$\begin{cases} y+4 & \geq & 0 \\ 2x+y-4 & \leq & 0 \\ x-y-2 & \geq & 0 \end{cases}$$

Let D be the region which represents the solution of the above system of inequalities. Find the range of values of b such that the greatest value of $6x + by$ is 12, where (x, y) is a point lying in D.

A. $b \geq 3$
B. $b \leq -6$
C. $b \leq -6$ or $b \geq 3$
D. $-6 \leq b \leq 3$

38. In the figure, CT is a tangent to the circle $ABCD$. If $AB = BC$ and $\angle BCT = 58^\circ$, then $\angle ABC =$



A. 58°.
B. 62°.
C. 64°.
D. 68°.

39. If the line $3x - 4y + 2 = 0$ cuts the circle $x^2 + y^2 + 2x - 2y - 34 = 0$ at the points M and N, then the length of chord $MN =$

A. $\sqrt{11}$.
B. $2\sqrt{11}$.
C. $\sqrt{35}$.
D. $2\sqrt{35}$.

40. Let θ be the angle between two adjacent faces of a regular tetrahedron. Find $\cos\theta$.

A. $\frac{1}{\sqrt{3}}$

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

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

D. $\frac{1}{2\sqrt{3}}$

41. Let (5, 0), (–3, –4) be two vertices of a triangle. If the origin O is the orthocentre of the triangle, then the coordinates of the third vertex of the triangle are

A. (–2, 4) .
B. (–3, 6) .
C. (–3, 4) .
D. (–1, 2) .

42. There are 12 students in a class. If 5 students are selected from the class to form a committee consisting of 1 chairman, 2 vice-chairman and 2 members, how many different committees can be formed?

A. 11 880
B. 23 760
C. 47 520
D. 95 040

43. A student answers two multiple choice questions by guessing. The probabilities for the student to answer the first question and the second question correctly are 0.3 and 0.4 respectively. If the two events are independent, find the probability that the student answers at least one question correctly.

A. 0.12
B. 0.42
C. 0.58
D. 0.7

44. The standard deviation of the test scores of a class of student is 4 marks. Mary gets 72 marks in the test and the standard score is +2. If John get 60 marks in the test, the standard score is

A. –4
B. –2
C. –1
D. +1

45. It is given that n is an integer. Consider the group of numbers $\{1 + n, 3 + 2n, 5 + 3n, 7 + 4n, 9 + 5n\}$. Which of the following must be true?

I. The mean is $5 + 3n$.
II. The standard deviation is $\sqrt{2}\,(2 + n)$.
III. The range is positive.

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

End of Paper