Sacred Heart Canossian College
S6 Mock Examination 2018-2019
Mathematics Paper 2

Time allowed: 1 hour and 15 minutes

1. Answer **ALL** questions.
   All the answers should be marked with an HB pencil on the answer sheet provided.
2. For each question, mark only one answer.
   Two or more answers will score no marks.
3. All questions carry equal marks.
   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.

Section A

1. $9^{333} \cdot 7^{666} =$

   A. 21^{666}.
   B. 21^{999}.
   C. 63^{666}.
   D. 63^{999}.

2. If $\frac{k}{3-k} = \frac{x}{x-1}$, then $x =$

   A. $-\frac{k}{3}$.
   B. $\frac{k}{k-3}$.
   C. $\frac{k}{2k-3}$.
   D. $\frac{k}{2k+3}$.

3. $(3x-5y)^2 - (3x+5y)^2 =$

   A. $-30xy$.
   B. $-60xy$.
   C. 0.
   D. $10y$.

4. If m and n are constants such that $x^2 + mx \equiv (x - 3)(x + n) + 6$, then $m + n =$

A. -3.
B. -1.
C. 1.
D. 2.

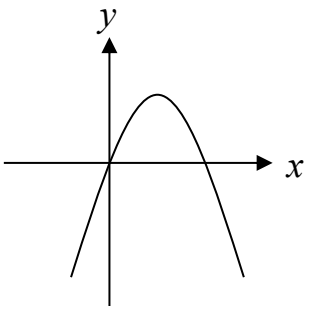
5. If \$250 000 is deposited at an interest rate of 8% per annum for 5 years, compounded monthly, find the amount correct to the nearest dollar.

A. \$122 461
B. \$367 332
C. \$372 461
D. \$629 543

6. Solve $-5-3x>1$ or $7x+15<-6$.

A. $x < -3$
B. $x < -2$
C. $-3 < x < -2$
D. $-2 < x < 3$

7. If $h > 0$, which of the following may represent the graph of $y=\frac{1}{h}(x+h)^2-h$?

A.


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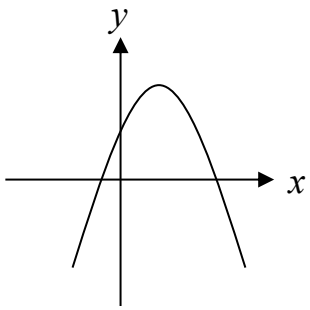

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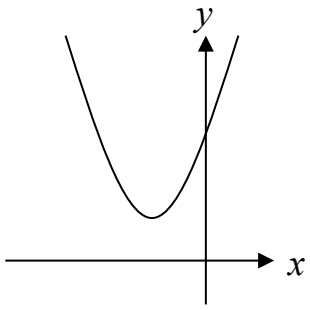

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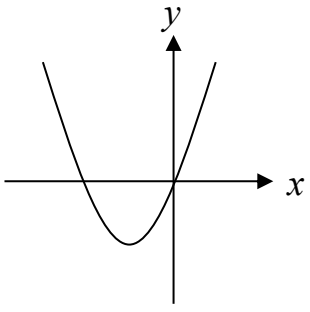


8. If β is a roots of the equation $x^2-2x-1=0$, then $5+6\beta-3\beta^2 =$

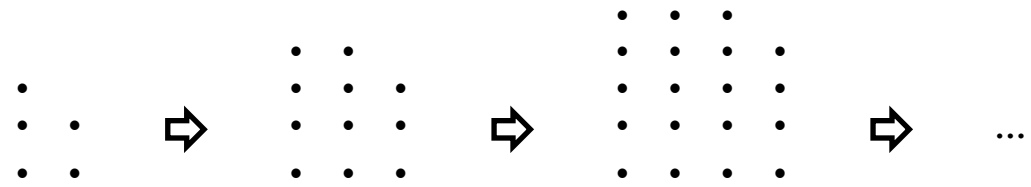
A. 1.
B. 2.
C. 3.
D. 4.

9. It is given that the ratio of the size of an interior angle to that of an exterior angle of a regular n-sided polygon is $7 : 2$. Which of the following must be true?

I. The number of folds of rotational symmetry of the polygon is 9 .
II. The number of axes of reflectional symmetry of the polygon is 9 .
III. The number of diagonals of the polygon is 9 .

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

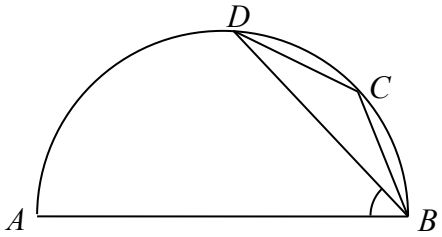
10. In the figure, the 1st pattern consists of 5 dots. For any positive integer n, the $(n + 1)$th pattern is formed by adding $(2n + 4)$ dots to the nth pattern. Find the number of dots in the 7th pattern.



A. 18
B. 41
C. 55
D. 71

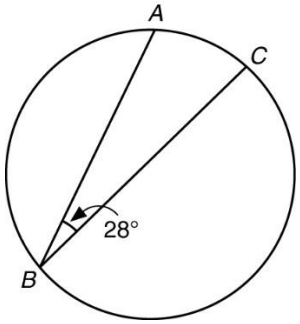
11. In the figure, $ABCD$ is a semi-circle. If $BC = CD$ and $\angle BDC = 20^\circ$, find $\angle ABD$.

A. 20°
B. 40°
C. 50°
D. 70°

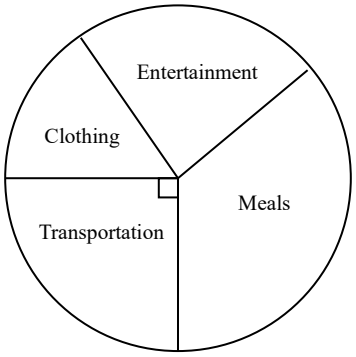


12. In the figure, $\angle ABC = 28^\circ$ and $AC = 7$ cm . Find the circumference of the circle.

A. 45 cm
B. 70 cm
C. 90 cm
D. 196 cm



13. The pie chart shows the expenditure of Nicole in a certain month. It is given that the ratio of the expenditure on clothing, entertainment and meals is $2:3:5$. If Nicole spends \$1350 on transportation that month, then her expenditure on meals that month is



A. \$ 675.
B. \$ 1215.
C. \$ 2025.
D. \$ 2700.

14. Let $\mathrm{f}(x)$ be a polynomial. If $\mathrm{f}(x)$ is divisible by $x-1$, which of the following must be a factor of $\mathrm{f}(3x-1)$?

A. $3x+4$
B. $3x+2$
C. $3x-2$
D. $3x-4$

15. Let $\mathrm{f}(x)=2x^3+kx^2-1$, where k is a constant. If $\mathrm{f}(x)$ is divisible by $2x+1$, find the remainder when $\mathrm{f}(x)$ is divided by $x+2$.

A. -5
B. 3
C. 27
D. 35

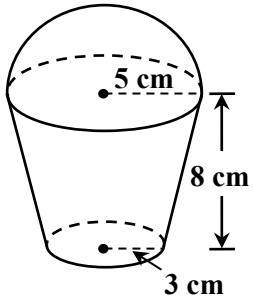
16. If z varies inversely as x and directly as the cube root of y, which of the following must be a constant?

A. $\dfrac{x^3z^3}{y}$
B. $\dfrac{yz^3}{x^3}$
C. $\dfrac{xz}{y^3}$
D. $\dfrac{y^3z}{x}$

17. It is given that z partly varies directly as x^2 and partly varies inversely as y.
When $x=1,\ y=2,\ z=-2$ and when $x=2,\ y=5,\ z=10$. When $x=-2,\ y=-1,\ z=$

A. -22.
B. -2.
C. 2.
D. 22.

18. In the figure, the solid consists of a frustum and a hemisphere. The frustum of height 8 cm is made by cutting off a right circular cone of base radius 3 cm from a solid right circular cone of base radius 5 cm. The radius of the hemisphere is 5 cm. Find the volume of the solid.



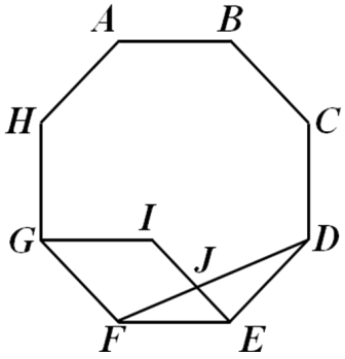
A. $\frac{358}{3}\pi$ cm^3

B. 150π cm^3

C. 214π cm^3

D. 250π cm^3

19. In the figure, *ABCDEFGH* is a regular octagon. If *EFGI* is a parallelogram, then $\angle DJI =$



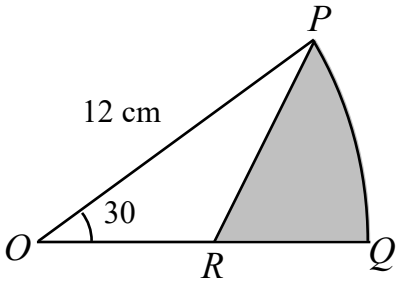
A. $112.5°$.

B. $94.5°$.

C. $90°$.

D. $67.5°$.

20. In the figure, *OPQ* is a sector with centre *O*. *OP* = 12 cm and $\angle POQ = 30°$. If *R* is the mid-point of *OQ*, then the area of the shaded region is



A. $6(4\pi - 3\sqrt{3})$ cm^2.

B. $6(4\pi - 3)$ cm^2.

C. $6(2\pi - 3)$ cm^2.

D. $12(\pi - 3)$ cm^2.

21. Let *n* be the smaller one of two consecutive even numbers. If the difference of the squares of the two even numbers is less than the product of the two even numbers by 4, then

A. $(n+2)^2 - n^2 = n(n+2) + 4$.

B. $(n+2)^2 - n^2 = n(n+2) - 4$.

C. $(n+1)^2 - n^2 = n(n+1) + 4$.

D. $(n+1)^2 - n^2 = n(n+1) - 4$.

22. The rectangular coordinates of the point P are $\left(2\sqrt{3}, -2\right)$. If P is rotated clockwise about the origin through $90°$, then the polar coordinates of its image are

A. $(2, 60°)$.

B. $(4, 60°)$.

C. $(2, 240°)$.

D. $(4, 240°)$.

23. If the graph of $y = \mathrm{g}(x)$ is obtained by reflecting the graph of $y = -(x-1)^2 + 4$ about the $y-$axis, which of the following must be true?

A. The graph of $y = \mathrm{g}(x)$ opens upwards.

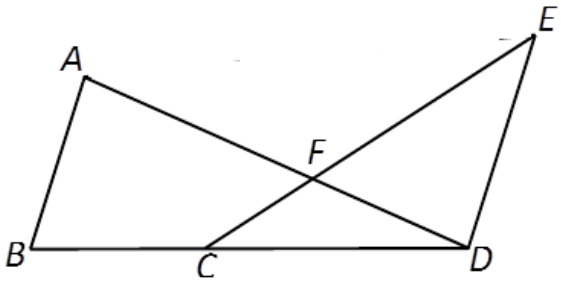
B. The graph of $y = \mathrm{g}(x)$ and the graph of $y = -(x-1)^2 + 4$ intersect at the point $(0,4)$.

C. The equation of the axis of symmetry of the graph of $y = \mathrm{g}(x)$ is $x = 1$.

D. The graph of $y = \mathrm{g}(x)$ cuts the $x-$axis at two points.

24. In the figure, *AFD*, *BCD* and *CFE* are straight lines. It is given that *AB* // *ED*, *AB* : *ED* = 5 : 7 and *BC* : *CD* = 2 : 3. If the area of $\triangle CDF$ is 63 cm^2, then the area of *ABCF* is

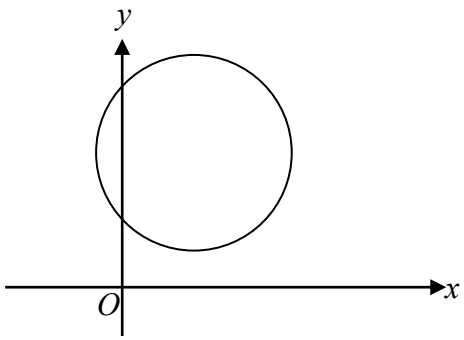
A. 150 cm^2.
B. 187 cm^2.
C. 217 cm^2.
D. 250 cm^2.



25. In the figure, the equation of the circle is $(x-h)^2 + (y-k)^2 = r^2$. Which of the following are true?

I. $r - h > 0$
II. $r - k < 0$
III. $h - k > 0$

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

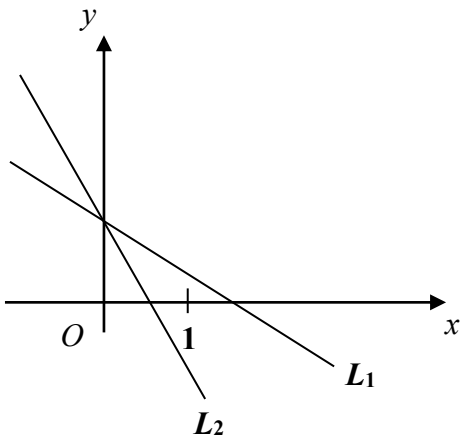


26. A and B are two points in the rectangular coordinate plane. It is given that P is a moving point on the straight line $L : y = k$, where k is a constant. The locus of the centroid of $\triangle ABP$ is

A. a straight line parallel to AB.
B. a straight line parallel to L.
C. the perpendicular bisector of AB.
D. a parabola passes through A and B.

27. In the figure, the equations of the straight lines L_1 and L_2 are $ax + by + 1 = 0$ and $dx + ey + 1 = 0$ respectively. Which of the following are true?

I. $a < -1$
II. $d < -1$
III. $ae < bd$
IV. $b = e$



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

28. The probabilities that John and Mary can finish a game are 0.6 and 0.55 respectively. If they play the game independently, then the probability that at least one of them can finish the game is

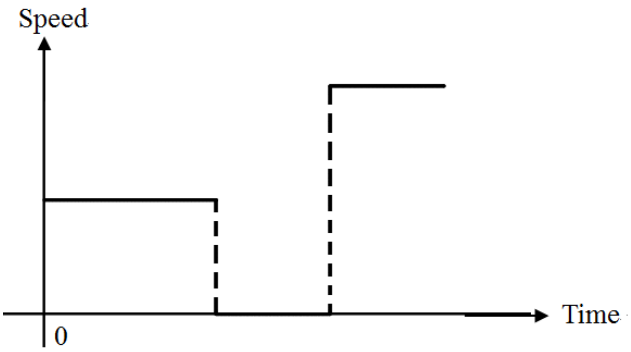
A. 0.18 .
B. 0.33 .
C. 0.49 .
D. 0.82 .

29. If the mode of the six numbers $2, 3, 5, 8, x$ and $x+2$ is 5, which of the following must be true?

I. The mean is 5.
II. The range is 6.
III. The inter-quartile range is 4.

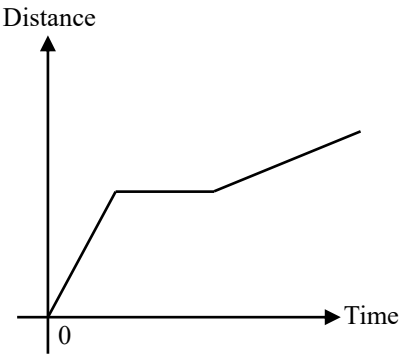
A. II only
B. I and II only
C. II and III only
D. I, II and III

30.

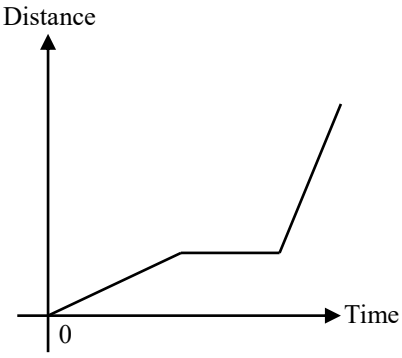


The figure above shows the speed-time graph of a car. Which of the following may represent the distance-time graph of the car?

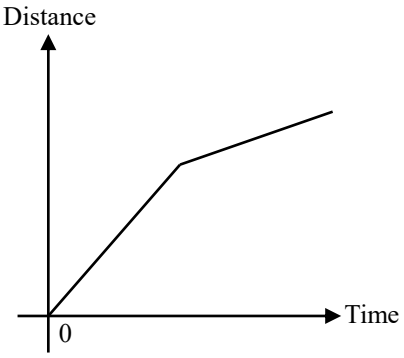
A.



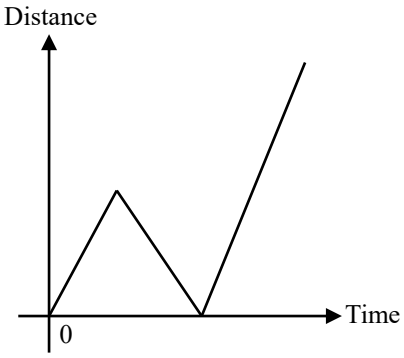
B.



C.



D.



Section B

31. $\dfrac{5}{x^2+x-6}-\dfrac{6}{x^2-9}=$

A. $-\dfrac{1}{(x-2)(x+3)}$.

B. $-\dfrac{1}{(x-2)(x-3)}$.

C. $-\dfrac{1}{(x-2)(x-3)(x+3)}$.

D. $-\dfrac{x+27}{(x-2)(x-3)(x+3)}$.

32. $1\ 100\ 100\ 011\ 110_2 =$

A. $2^{12} + 2^{11} + 2^8 + 30$
B. $2^{12} + 2^{11} + 2^9 + 30$
C. $2^{13} + 2^{12} + 2^8 + 30$
D. $2^{13} + 2^{12} + 2^9 + 30$

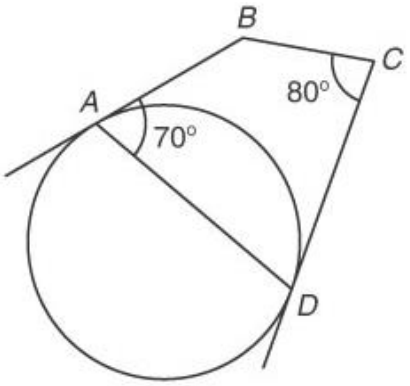
33. For $0° \leq \theta < 360°$, how many roots does the equation $\sin^2\theta = \cos^2\theta$ have?

A. 1
B. 2
C. 3
D. 4

34. If the circle $x^2 + y^2 - 5x - 9y + 24 = 0$ and the straight line $kx - y + 2 = 0$ do not intersect, then

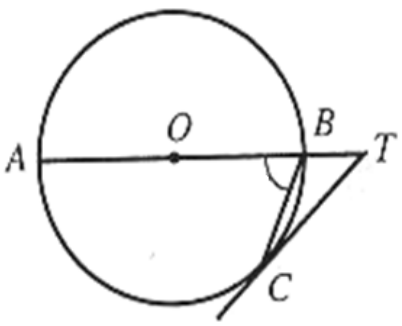
A. $k < \frac{1}{3}$ or $k > 3$.
B. $k < -3$ or $k > -\frac{1}{3}$.
C. $\frac{1}{3} < k < 3$.
D. $-3 < k < -\frac{1}{3}$.

35. In the figure, AB and CD are tangents to the circle at A and D respectively. Find $\angle ABC$.



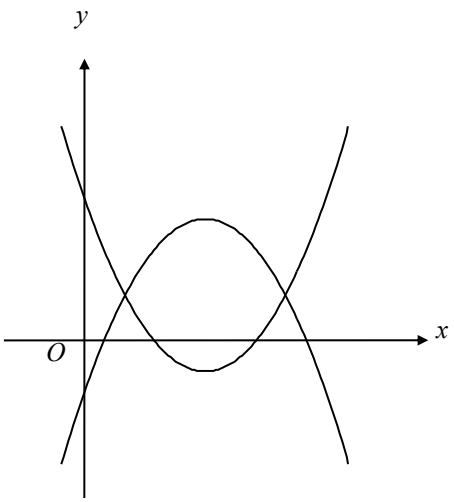
A. 120°
B. 130°
C. 140°
D. 150°

36. In the figure, O is the centre of the circle ABC , $AOBT$ is a straight line and CT is the tangent to the circle at C . If $\angle ABC = 55°$, then $\angle ATC =$



A. $10°$.
B. $15°$.
C. $20°$.
D. $25°$.

37. Let $\mathrm{f}(x)$ be a quadratic function. The figure may represent the graph of $y = \mathrm{f}(x)$ and



A. the graph of $y = 1 + \mathrm{f}(-x)$.

B. the graph of $y = 1 - \mathrm{f}(x)$.

C. the graph of $y = -1 + \mathrm{f}(-x)$.

D. the graph of $y = -1 - \mathrm{f}(x)$.

38. A student is selected at random from 300 students in a school. The probability the selected student wears glasses is $\frac{37}{60}$. If the probability of the selected student is a girl given that the student wears glasses is $\frac{13}{37}$, then the number of girls that wear glasses is

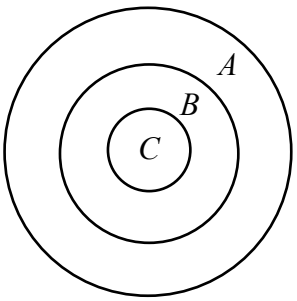
A. 65 .

B. 105 .

C. 115 .

D. 185 .

39. A target contains concentric circles of radius *r*, 2*r* and 3*r* as shown in the figure. Mary throws dart randomly on the target. She can get 1 mark for hitting region *A*, 2 marks for region *B* and 3 marks for region *C*, find the probability she can get a total of 4 marks for throwing two darts. Suppose she will not miss the target.



A. $\frac{19}{81}$

B. $\frac{14}{81}$

C. $\frac{7}{36}$

D. $\frac{5}{18}$

40. It is given that a and b are real roots of the equation $x^2 - 4x + p = 0$. If $(a+bi)^2 = 8+6i$, where $i = \sqrt{-1}$, then

A. $a - b = 2$ and $p = 3$.

B. $a - b = -2$ and $p = -3$.

C. $a - b = 4$ and $p = 3$.

D. $a - b = -4$ and $p = -3$.

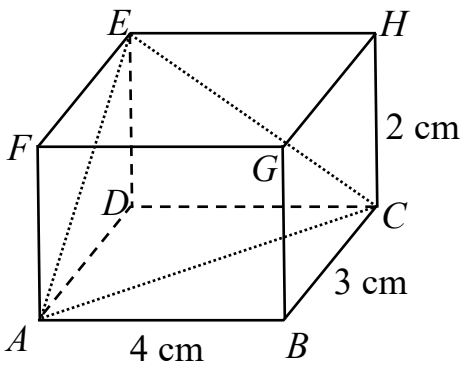
41. In the figure, $ABCDEFGH$ is a rectangular block. $AB = 4$ cm, $BC = 3$ cm and $CH = 2$ cm. If the angle between $\triangle ACE$ and the plane $ABCD$ is x, then $\tan x =$

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

B. $\frac{5}{6}$.

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

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



42. Let a_n be the nth term of a sequence. If $a_n = 2016\left(\frac{1}{2}\right)^n$, which of the following are true?

I. There are 10 terms greater than 1.

II. $a_{n-1} - a_n = 2(a_n - a_{n+1})$

III. $a_2 + a_4 + \ldots + a_{2n} < 689$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

43. If $\begin{cases}\log_2 y = x+2 \\ (\log_2 y)^2 = 10+3x\end{cases}$, then $y =$

A. $\frac{1}{2}$ or 16.

B. $\frac{1}{16}$ or 2.

C. 16 or $\frac{1}{8}$.

D. 8 or $\frac{1}{2}$.

44. In a class, the mean and the standard deviation of a coursework are 60 marks and 12 marks respectively. Grade 'A' will be given if the standard score is 2.25 or above. If Amy wants to get grade 'A', at least how many marks should she get?

A. 85

B. 87

C. 90

D. 92

45. Let x_1, y_1 and z_1 be the mean, median and the variance of a group of numbers $\{a_1, a_2, a_3, ..., a_n\}$ respectively while x_2, y_2 and z_2 be the mean, median and the variance of the group of numbers $\{a_1+1, a_2+1, a_3+1, ..., a_n+1, x_1+1\}$ respectively. Which of the following must be true?

I. $x_2 - x_1 = 1$

II. $y_2 - y_1 = 1$

III. $z_2 - z_1 = 1$

A. I only

B. II only

C. I and II only

D. I, II and III

END OF PAPER