2021-2022 - MOCK
MATH CP
PAPER 2

DIOCESAN BOYS' SCHOOL
GRADE 12 MOCK EXAMINATION 2021-2022

MATHEMATICS Compulsory Part
PAPER 2

11:15 am – 12:30 pm ($1\frac{1}{4}$ hours)

Name: ________________________ (_____) Class: ________ Group: ____________

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should write your name, class number, class and group in the spaces provided. No extra time will be given for writing anything after the 'Time is up' announcement.

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. 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. $\dfrac{(3^{4m})(81^m)}{27^{2m}} =$

   A. 3^{-4m} .

   B. 3^{4m} .

   C. 3^{-2m} .

   D. 3^{2m} .

2. If $p(-q-p) = -3(p-q)$, then $q =$

   A. p .

   B. $\dfrac{p(p-3)}{p+3}$.

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

   D. $\dfrac{p(3-p)}{p+3}$.

3. $(2-q)(p+2q)(-2p+4q) =$

   A. $8q^3 - 16q^2 - 2p^2q - 4p^2$.

   B. $4q^3 - 8q^2 - p^2q + 2p^3$.

   C. $-8q^3 + 16q^2 + 2p^2q - 4p^2$.

   D. $-4q^3 + 16q^2 + 2p^2q + 4p^2$.

4. $-\dfrac{3}{x-4}-\dfrac{5}{6-x}=$

A. $\dfrac{2(x-1)}{(x-4)(x-6)}$.

B. $\dfrac{-2(x-2)}{(x-4)(6-x)}$.

C. $\dfrac{2(x-19)}{(x-4)(x-6)}$.

D. $\dfrac{-2(4x+1)}{(x-4)(6-x)}$.

5. If a, b and c are non-zero constants such that $a(x-1)+b(x+2)-c(x+1)\equiv 0$, then $a:c=$

A. $1:2$.

B. $2:1$.

C. $1:3$.

D. $3:1$.

6. Let α and β be constants. If $f(x)=3x^2-\alpha x+1$, then $f(\beta-1)-f(\beta+1)=$

A. 2α .

B. $2\alpha+4\beta$.

C. $2\alpha-6\beta$.

D. $2\alpha-12\beta$.

7. Let $p(x)$ be a polynomial. When $p(x)$ is divided by $x+2$, the remainder is 8. If $x-2$ is a factor of $p(x)$, find the remainder when $p(x)$ is divided by x^2-4 .

A. 8

B. $2x-4$

C. $2x+4$

D. $-2x+4$

8. There are 150 teachers in a school. 20% of them are foreigners and there are 12 male foreign teachers. If 75% of the female teachers are local citizens, how many male teachers are local citizens?

A. 30

B. 60

C. 66

D. 78

9. The solution of $\frac{1-2x}{3} \geq x-3$ or $6-7x \geq 20$ is

A. $x \geq 2$.

B. $x \leq -2$.

C. $x \leq 2$.

D. $-2 < x \leq 2$.

10. Let p, q and r be non-zero numbers such that $\frac{4p+3r}{2p+9r} = \frac{3}{4}$. If $q:r = 4:3$, then $(p+q):(q-r) =$

A. $3:1$.

B. $6:1$.

C. $17:2$.

D. $17:4$.

11. It is given that v varies directly as the square root of x and inversely as the square of y. If x is increased by 21% and y is decreased by 90%, then v is increased by

A. 1.09% .

B. 10% .

C. 109% .

D. 10900% .

12. Let a_n be the nth term of a sequence. If $a_5 = 5$, $a_8 = -7$ and $a_{n+2} = 2a_n - a_{n+1}$ for any positive integer n, then $a_7 =$

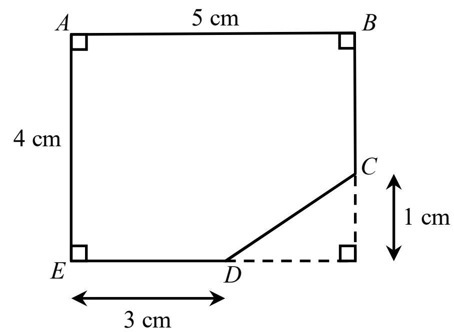
A. 5 .

B. 7 .

C. 9 .

D. 12 .

13. In the figure, $ABCDE$ is a pentagon, where all the measurements are correct to the nearest cm. Let S cm^2 be the actual area of the pentagon. Find the range of values of S.



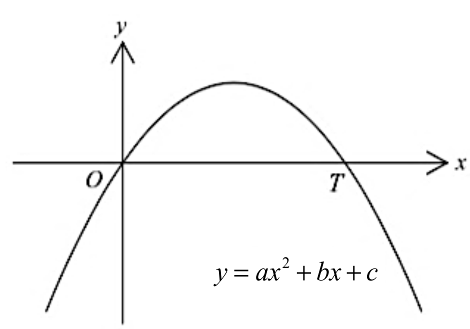
A. $14.25 < S < 24.25$

B. $14.75 \le S < 23.75$

C. $15 < S < 23.25$

D. $15.25 \le S < 22.75$

14. In the figure, the graph of $y = ax^2 + bx + c$ cuts the x-axis at the origin O and the point T, where a, b and c are real constants. If the coordinates of T are $(10, 0)$, which of the following is/are true?



I. $ab > 0$
II. $c \le 0$
III. $8a + b > 0$

A. II only

B. I and III only

C. II and III only

D. I, II and III

15. The length of the longest diagonal of a solid cuboid is 25 cm. If the length and the width of the base of the cuboid are 20 cm and 9 cm respectively, then the total surface area of the cuboid is

A. 696 cm^2.

B. 878 cm^2.

C. 1056 cm^2.

D. 2160 cm^2.

16. The ratio of the base radius to the slant height of a solid right circular cone is $8:17$. If the total surface area of the cone is $50\pi \text{ cm}^2$, then the volume of the cone is

A. $40\pi \text{ cm}^3$.

B. $120\pi \text{ cm}^3$.

C. $\frac{136}{3}\pi \text{ cm}^3$.

D. $\frac{272}{3}\pi \text{ cm}^3$.

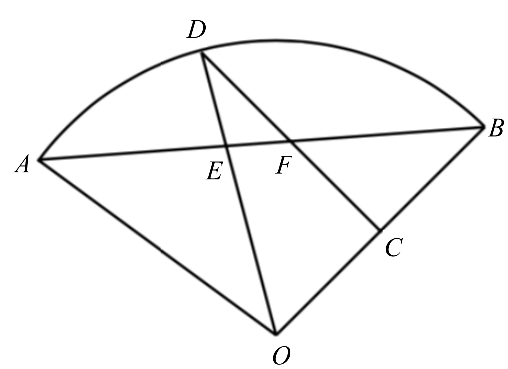
17. In the figure, O is the centre of the sector $OADBC$. D is a point on $\overset{\frown}{AB}$ such that DC is the perpendicular bisector of OB. If $CD = 6\sqrt{3}$ and $\angle DEF = 105°$, then the area of the sector OAD is

A. 12π.

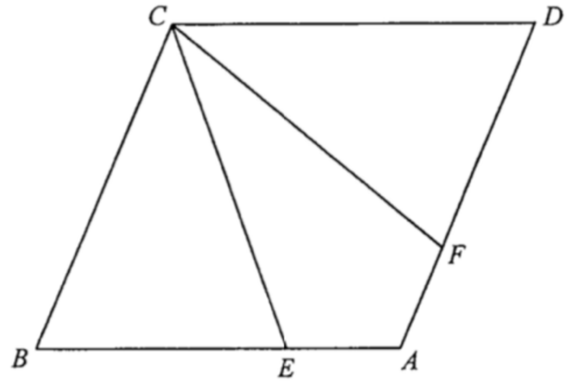
B. 18π.

C. 24π.

D. 36π.



18. In the figure, $ABCD$ is a rhombus. E and F are points lying on AB and AD respectively such that $BE = DF$ and $\angle ECF = 42°$. If $\angle ADC = 80°$, then $\angle AEC =$



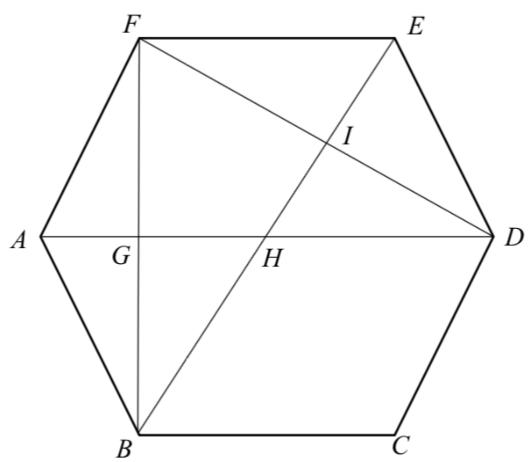
A. 92° .

B. 100° .

C. 109° .

D. 122° .

19. In the figure, $ABCDEF$ is a regular hexagon. AD intersects BF and BE at the points G and H respectively. DF and EB intersect at the point I. Which of the following are true?



I. $\Delta BGH \sim \Delta DIH$
II. $\Delta EFI \cong \Delta HBG$
III. $\Delta IED \cong \Delta GAF$

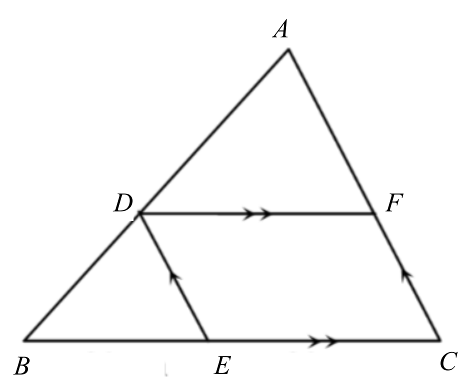
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

20. In the figure, D, E and F are points lying on AB, BC and AC respectively such that $DECF$ is a parallelogram. If $BD : DA = 2 : 3$ and the area of ΔABC is 450, then the area of the parallelogram $DECF$ is



A. 108 .

B. 162 .

C. 216 .

D. 234 .

21. If $ABCDEFGHI$ is a regular nonagon, which of the following is/are true?

I. ΔHCF is an isosceles triangle.
II. $BG \,//\, DE$
III. $\angle GCD = 3\angle IGH$

A. III only

B. I and II only

C. I and III only

D. II and III only

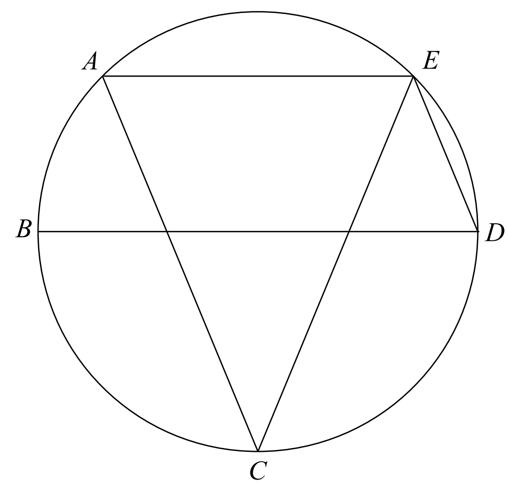
22. In the figure, $ABCDE$ is a circle with diameter BD. If $AE \,//\, BD$ and $\angle BDE = 68°$, then $\angle ACE =$

A. $22°$.

B. $34°$.

C. $46°$.

D. $56°$.



23. The point P is translated leftwards by 4 units to the point Q. Q is then rotated clockwise about the origin through $90°$ to the point R. If the coordinates of the reflection image of R with respect to the y-axis are $(5, -1)$, then the x-coordinate of P is

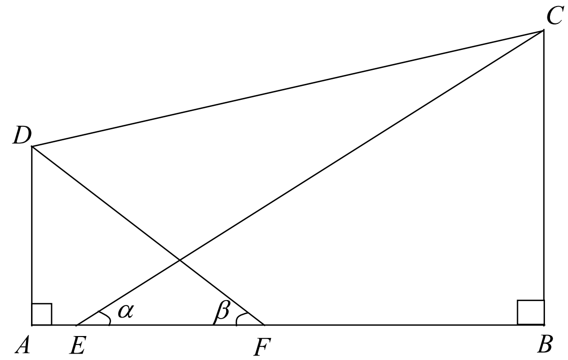
A. -5 .

B. -3 .

C. 3 .

D. 5 .

24. In the figure, $ABCD$ is a trapezium with $\angle ABC = \angle BAD = 90°$. If E and F are points lying on AB such that $AE : EF : FB = 1:3:5$, then $CE : DF =$



A. $2\cos\beta : \cos\alpha$.

B. $2\cos\alpha : \cos\beta$.

C. $\cos\beta : 2\cos\alpha$.

D. $\cos\alpha : 2\cos\beta$.

25. The equation of the straight line L is $y = x - 1$. Let P be a moving point in the rectangular coordinate plane such that the perpendicular distance from P to L is $\sqrt{2}$. Find the equation(s) of the locus of P.

A. $y = x + 1$

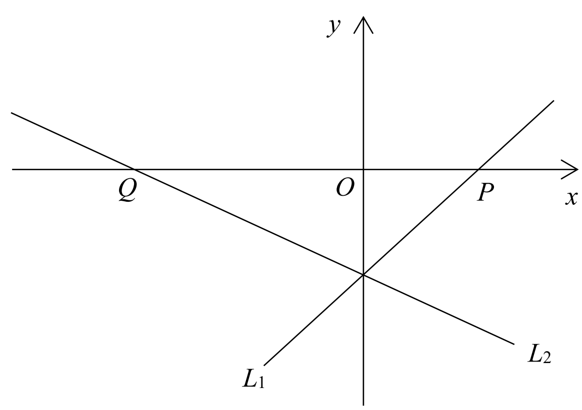
B. $y = x - 3$ and $y = x + 1$

C. $y = x + 1 - \sqrt{2}$

D. $y = x + 1 - \sqrt{2}$ and $y = x + 1 + \sqrt{2}$

26. In the figure, O is the origin. The equations of the straight lines L_1 and L_2 are $x + ay = -a$ and $cx + y = -b$ respectively, where a, b and c are non-zero constants. L_1 and L_2 meet on the y-axis, and cut the x-axis at P and Q respectively. If $PQ > 2OP$, which of the following is/are true?

I. $a < 0$
II. $a = b$
III. $ac > -1$



A. I only

B. I and III only

C. II and III only

D. I, II and III

27. The equations of the circles C_1 and C_2 are $(x-2)^2+(y+1)^2=9$ and $4x^2+4y^2-16x-32y+55=0$ respectively. Let H and K be the centres of C_1 and C_2 respectively. Denote the origin by O. Which of the following is true?

A. O lies inside C_2 .

B. The area of C_1 is smaller than the area of C_2 .

C. C_1 touches C_2 .

D. $OH \perp OK$

28. The stem-and-leaf diagram below shows the distribution of the numbers of prizes won by a group of 20 sportsmen in a decade.

Stem (tens)	Leaf (units)						
2	1	2	2	8			
3	a	a					
4	0	2	4	5	5	7	8
5	3						
6	b	b	9	9			
7	0	8					

It is given that the inter-quartile range of the above distribution is at most 25. If a sportsman is randomly selected from the group, find the probability that he/she won at least 65 prizes in the decade.

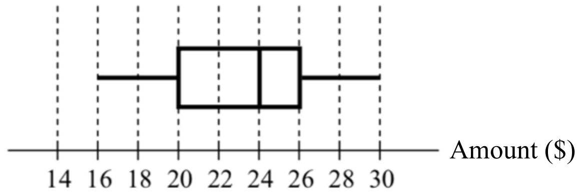
A. 0.1

B. 0.2

C. 0.3

D. Cannot be determined

29. The box-and-whisker diagram below shows the distribution of the expenses (in dollars) of a group of customers in a shop.



Which of the following must be true?

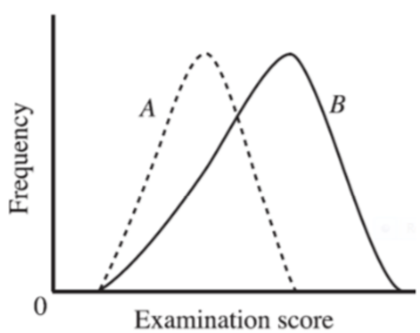
A. The inter-quartile range of the distribution is $6.

B. The mean of the distribution is $24.

C. More than half of the customers spent less than $24.

D. 25% of the customers spent more than $26.

30. The figure below shows the frequency curves of two examination score distributions A and B. Which of the following is/are true?



I. Mode of A < Mode of B
II. Mean of A < Mean of B
III. Standard deviation of A < Standard deviation of B

A. I only

B. I and III only

C. II and III only

D. I, II and III

Section B

31. The H.C.F. and the L.C.M. of three expressions are x^2y^2 and $6x^4y^5z^6$ respectively. If the first expression and the second expression are $2x^2y^3z^4$ and $3x^4y^5z^6$ respectively, then the third expression can be

A. $2x^4y^4$.

B. $3x^2y^2$.

C. $3x^4y^2z^6$.

D. $6x^3y^2z^6$.

32. $10000000070_8 + \mathrm{C000000E0}_{16} =$

A. $17\times 2^{30}+16\times 2^{5}$.

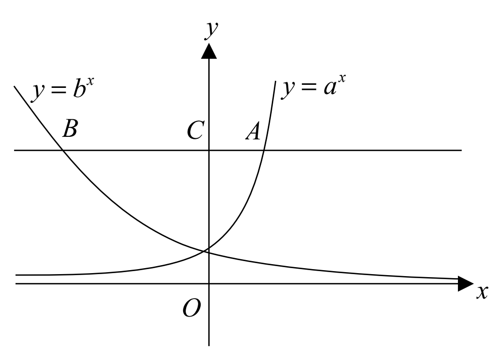
B. $49\times 2^{30}+35\times 2^{3}$.

C. $49\times 2^{30}+21\times 2^{5}$.

D. $97\times 2^{33}+63\times 2^{6}$.

33. The figure shows the graph of $y=a^x$ and the graph of $y=b^x$ on the same rectangular coordinate system, where a and b are positive constants. If a horizontal line cuts the graph of $y=a^x$, the graph of $y=b^x$ and the y-axis at A, B and C respectively, which of the following is/are true?

I. $a>b$
II. $ab>1$
III. $\dfrac{AC}{BC}=\log_a b$



A. I only

B. I and II only

C. I and III only

D. II and III only

34. It is given that $\log_4 y$ is a linear function of $\log_4 x$. If $y = 8\sqrt{x}$, then the product of the intercept on the vertical axis and the intercept on the horizonal axis of the graph of the linear function is

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

B. $-\frac{8}{9}$.

C. $\frac{3}{4}$.

D. 3.

35. If a is a real number, then the imaginary part of $i^{22} - \frac{5ai^{23}}{2+i^{21}}$ is

A. $2a$.

B. $-2a$.

C. $2ai$.

D. $-2ai$.

36. If $a > 0$, which of the following must be (an) arithmetic sequence(s)?

I. $-a$, a, $2a$
II. $\log a^2$, $\log a^3$, $\log a^4$
III. $\sin(180-a)°$, $\cos(90-a)°$, $\tan(180-a)°\sin(270+a)°$

A. I only

B. II only

C. III only

D. II and III only

37. Consider the following system of inequalities:

$$\begin{cases} x \le 8 \\ y > 4 \\ 2x \ge y \\ x + 4y \le 36 \end{cases}$$

Let D be the region which represents the solution of the above system of inequalities. If $(x,\ y)$ is a point lying in D, where x and y are integers, then the least value of $11x - 5y$ is

A. 2 .

B. 3 .

C. 4 .

D. 5 .

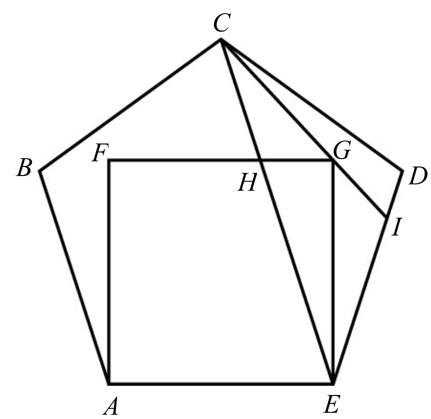
38. In the figure, $ABCDE$ is a regular pentagon and $AFGE$ is a square. H and I are points lying on FG and DE respectively such that CHE and CGI are straight lines. If $EG = 20$, find the area of ΔECI correct to 3 significant figures.

A. 147

B. 148

C. 161

D. 162



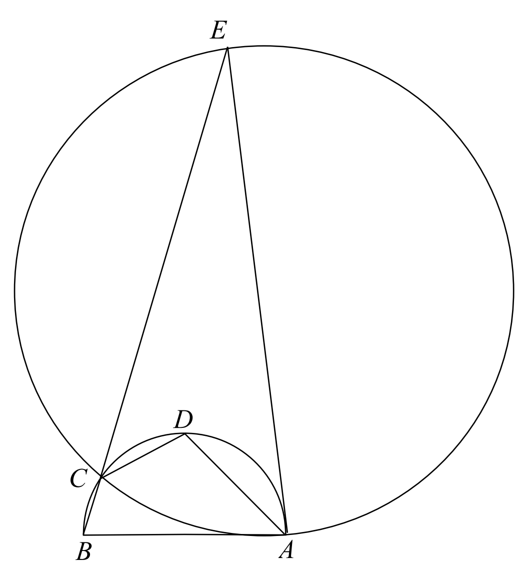
39. In the figure, ACE is a circle and $BCDA$ is a semi-circle. AB is the tangent to the circle at A. If $6\overset{\frown}{BC} = 3\overset{\frown}{CD} = 2\overset{\frown}{AD}$ and $\angle DCE = 46°$, then $\angle DAE =$

A. $42°$.

B. $44°$.

C. $46°$.

D. $48°$.



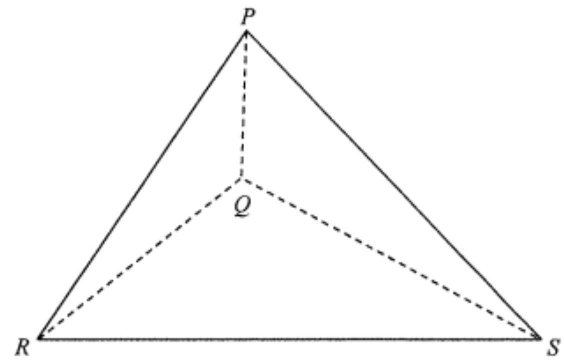
40. The figure shows a tetrahedron $PQRS$ with the base QRS lying on the horizontal ground. Q is vertically below P. If $\angle PRQ = 45°$, $\angle PSQ = 60°$ and $\angle RQS = 120°$, find $\angle RPS$ correct to the nearest degree.

A. 60°

B. 64°

C. 68°

D. 116°



41. It is given that a is a negative constant. The straight line $4x+3y-a=0$ cuts the x-axis and the y-axis at the points P and Q respectively. Let R be a point lying on the x-axis such that the y-coordinate of the orthocentre of ΔPQR is $\frac{3}{2}$. Find the x-coordinate of R.

A. –3

B. –2

C. 2

D. 3

42. Jeffery and Lok play a game. In the game, there are box X and box Y. Box X contains 2 cards which are numbered 4 and 10 respectively while box Y contains 8 cards which are numbered 1, 2, ..., 8 respectively. The players take turns to randomly draw one card from each box with replacement. If the number of the card drawn from box X is not smaller than the number of the card drawn from box Y, then the player wins the game. Jeffery draws cards first and the game continues until one of them wins the game. Find the probability that Lok wins the game.

A. $\frac{1}{5}$

B. $\frac{5}{21}$

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

D. $\frac{3}{4}$

43. A bag contains 5 gold coins and 6 silver coins. Matthew repeats drawing one coin at a time randomly from the bag without replacement until a gold coin is drawn. Given that he needs at least 4 draws, find the probability that he needs exactly 5 draws.

A. $\frac{5}{7}$

B. $\frac{5}{8}$

C. $\frac{5}{154}$

D. $\frac{15}{56}$

44. In an examination, the standard deviation of the examination scores is x marks. The examination score of Calix is 70 marks and his standard score is 0.8 . If the standard score of Danny is –1.2 , then his examination score is

A. $(70-2x)$ marks.

B. $(70-1.2x)$ marks.

C. $(70-0.8x)$ marks.

D. $(70-0.4x)$ marks.

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 mean and the variance of the group of numbers $\{T(1),\ T(2),\ T(3),\ \ldots,\ T(49)\}$ respectively while x_2 , y_2 and z_2 be the median, the mean and the variance of the group of numbers $\{T(1),\ T(2),\ T(3),\ \ldots,\ T(50)\}$ respectively. Which of the following must be true?

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

A. II only

B. I and II only

C. II and III only

D. I, II and III

END OF PAPER