HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2020

MATHEMATICS Compulsory Part
PAPER 2

11:30 am – 12:45 pm (1¼ hours)

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label 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.

Not to be taken away before the end of the examination session

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. $\dfrac{6x}{(3x^{-5})^{-2}} =$

A. $54x^8$.

B. $\dfrac{2x^8}{3}$.

C. $\dfrac{54}{x^9}$.

D. $\dfrac{2}{3x^9}$.

2. If $a(a+b)=2(b-a)$, then $b=$

A. $\dfrac{a^2+a}{2+a}$.

B. $\dfrac{a^2-2a}{2+a}$.

C. $\dfrac{a^2+2a}{2-a}$.

D. $\dfrac{a^2-a}{2-a}$.

3. $\dfrac{5}{4k+3}-\dfrac{2}{4k-3} =$

A. $\dfrac{12k-21}{16k^2-9}$.

B. $\dfrac{12k+9}{16k^2-9}$.

C. $\dfrac{14k-21}{16k^2-9}$.

D. $\dfrac{14k+9}{16k^2-9}$.

4. $(3a+2b)(4a-5b)-a(6a+4b)=$

A. $(3a+2b)(2a-5b)$.

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

C. $(3a-2b)(2a+5b)$.

D. $(3a-2b)(6a+5b)$.

5. Let $f(x)=3x^2-x-2$. If β is a constant, then $f(1+\beta)-f(1-\beta)=$

A. 2β .

B. 10β .

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

D. $6\beta^2-2\beta$.

6. Let $g(x)=ax^3+4ax^2-24$, where a is a constant. If $x+2$ is a factor of $g(x)$, then $g(2)=$

A. -96 .

B. 0 .

C. 3 .

D. 48 .

7. If h and k are constants such that $(x+h)(x+6)\equiv(x+4)^2+k$, then $k=$

A. -28 .

B. -16 .

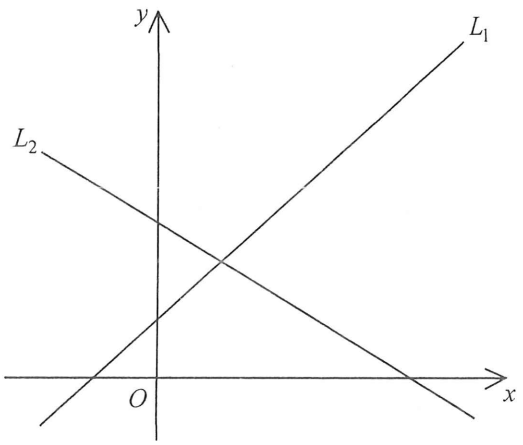
C. -4 .

D. 2 .

Go on to the next page

8. In the figure, the equations of the straight lines L_1 and L_2 are $x+ay+b=0$ and $bx+y+c=0$ respectively. Which of the following are true?

I. $c<0$
II. $ab<1$
III. $ac<b$



A. I and II only

B. I and III only

C. II and III only

D. I, II and III

9. The cost of a toy is $x\%$ lower than its selling price. After selling the toy, the percentage profit is 25%. Find x.

A. 20

B. 25

C. 75

D. 80

10. The actual area of a golf course is $0.75\,\text{km}^2$. If the area of the course on a map is $300\,\text{cm}^2$, then the scale of the map is

A. $1:250$.

B. $1:5\,000$.

C. $1:62\,500$.

D. $1:25\,000\,000$.

11. It is given that w varies as the cube of u and the square root of v. When $u=2$ and $v=4$, $w=8$. When $u=4$ and $v=9$, $w=$

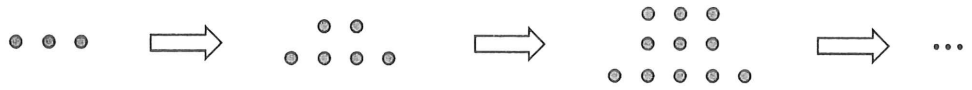
A. 96.

B. 324.

C. 384.

D. 729.

12. In the figure, the 1st pattern consists of 3 dots. For any positive integer n, the $(n+1)$th pattern is formed by adding $(2n+1)$ dots to the nth pattern. Find the number of dots in the 7th pattern.



A. 15

B. 27

C. 38

D. 51

13. The solution of $5-4x<9$ and $\frac{2x-3}{7}>1$ is

A. $x<-1$.

B. $x>-1$.

C. $x<5$.

D. $x>5$.

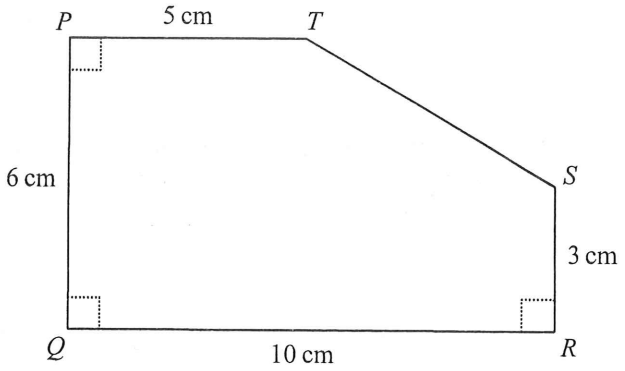
14. In the figure, $PQRST$ is a pentagon, where all the measurements are correct to the nearest cm. Let $A\text{ cm}^2$ be the actual area of the pentagon. Find the range of values of A.

A. $27.83 \leq A < 31.83$

B. $44.75 \leq A < 60.75$

C. $46.75 \leq A < 63.25$

D. $48.25 \leq A < 64.75$



15. The angle of a sector is decreased by 60% but its radius is increased by $k\%$. If the arc length of the sector remains unchanged, find the value of k.

A. 40

B. 60

C. 67

D. 150

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16. If the volume of a right circular cylinder of base radius $5a$ cm and height $7b$ cm is 525 cm^3, then the volume of a right circular cone of base radius $7a$ cm and height $5b$ cm is

A. 175 cm^3.

B. 245 cm^3.

C. 490 cm^3.

D. 735 cm^3.

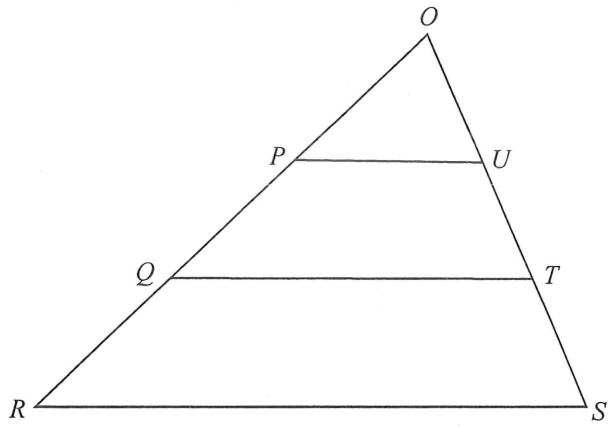
17. In the figure, P and Q are points lying on OR while U and T are points lying on OS such that $OP = PQ = QR$ and $PU // QT // RS$. The ratio of the area of the trapezium $PQTU$ to the area of the trapezium $QRST$ is

A. $1:2$.

B. $2:3$.

C. $3:5$.

D. $4:9$.



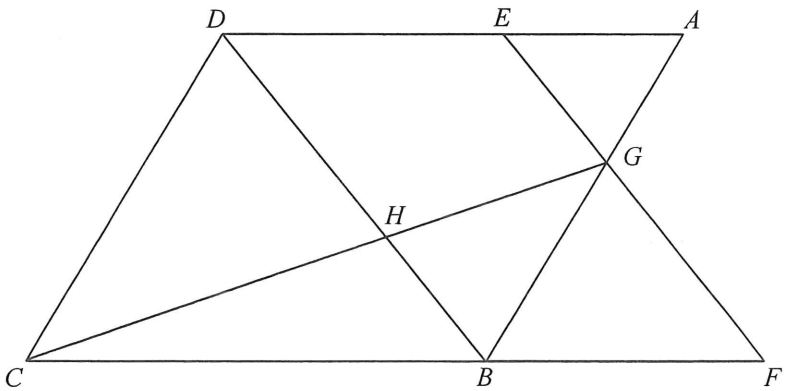
18. In the figure, $ABCD$ is a parallelogram. Let E be a point lying on AD such that $AE : ED = 2:5$. CB is produced to the point F such that $BF = DE$. Denote the point of intersection of AB and EF by G. It is given that BD and CG intersect at the point H. If the area of ΔAEG is 48 cm^2, then the area of ΔCDH is

A. 98 cm^2.

B. 343 cm^2.

C. 420 cm^2.

D. 588 cm^2.



19. According to the figure, which of the following must be true?

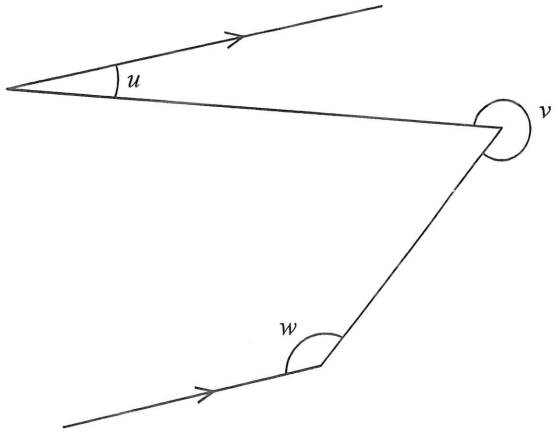
I. $u - v + w = 0°$
II. $u + v - w = 180°$
III. $u + v + w = 450°$

A. I only

B. II only

C. I and III only

D. II and III only



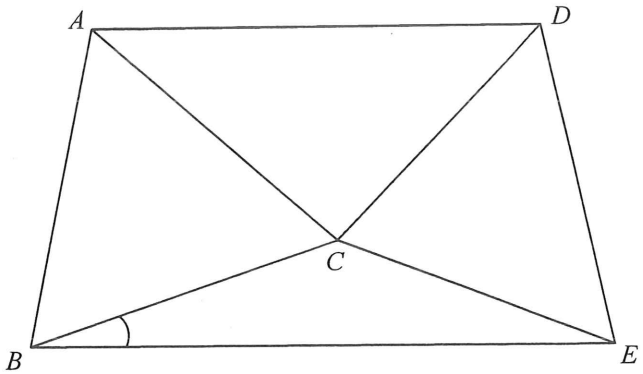
20. In the figure, ABC is an equilateral triangle and CDE is an isosceles triangle with $CD = CE$. If $\angle DCE = 78°$ and $\angle ADC = \angle CAD = 40°$, then $\angle CBE =$

A. $14°$.

B. $19°$.

C. $24°$.

D. $29°$.



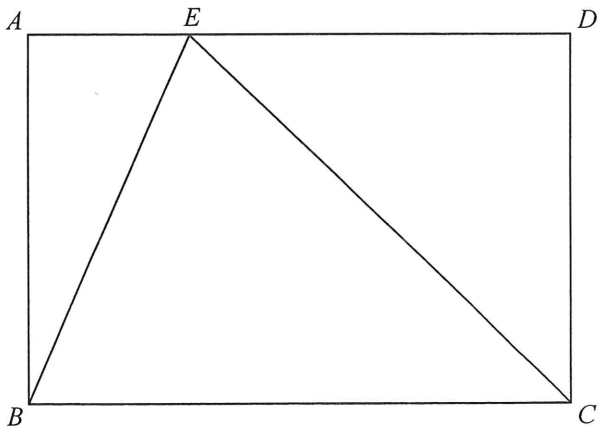
21. In the figure, $ABCD$ is a rectangle. Let E be a point lying on AD such that $BE = 8$ cm and $CE = 15$ cm. If $BC = 17$ cm, find the area of the rectangle $ABCD$.

A. $60\ \text{cm}^2$

B. $68\ \text{cm}^2$

C. $120\ \text{cm}^2$

D. $136\ \text{cm}^2$



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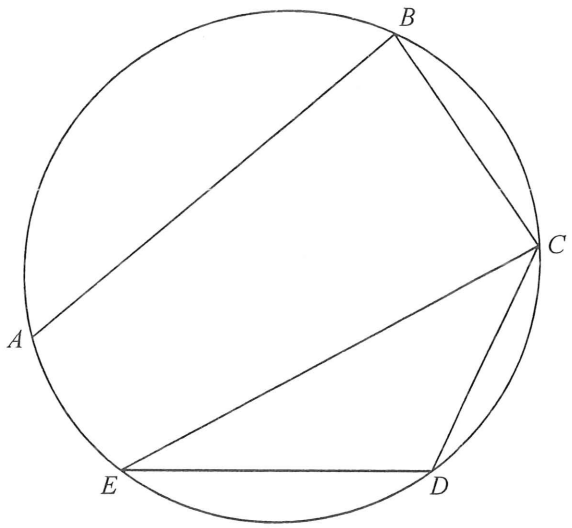
22. In the figure, $ABCDE$ is a circle. If $AB = 10$ cm, $BC = 5$ cm, $\angle ABC = 90°$ and $\angle CED = 40°$, find CD correct to the nearest cm.



A. 5 cm

B. 6 cm

C. 7 cm

D. 8 cm

23. A ship is 50 km due west of a lighthouse. If the ship moves in the direction S60°E, find the shortest distance between the ship and the lighthouse.

A. 20 km

B. 25 km

C. 43 km

D. 87 km

24. The point P is translated leftwards by 4 units to the point Q. If the coordinates of the reflection image of Q with respect to the y-axis are $(5, -1)$, then the polar coordinates of P are

A. $(1, 45°)$.

B. $(1, 225°)$.

C. $(\sqrt{2}, 45°)$.

D. $(\sqrt{2}, 225°)$.

25. Let A be the point of intersection of the straight lines $9x+4y-7=0$ and $9x-4y+7=0$. If P is a moving point in the rectangular coordinate plane such that the distance between P and A is 8, then the locus of P is a

A. circle.

B. triangle.

C. quadrilateral.

D. regular hexagon.

26. The equation of the straight line L is $kx+4y-2k=0$, where k is a constant. If L is perpendicular to the straight line $6x-9y+4=0$, find the y-intercept of L.

A. -3

B. -2

C. 2

D. 3

27. The equations of the circles C_1 and C_2 are $2x^2+2y^2+4x+8y-149=0$ and $x^2+y^2-8x-20y-53=0$ respectively. Which of the following is/are true?

I. The centre of C_1 lies on C_2.
II. The radii of C_1 and C_2 are equal.
III. C_1 and C_2 intersect at two distinct points.

A. I only

B. II only

C. I and III only

D. II and III only

Go on to the next page

28. Two numbers are randomly drawn at the same time from four cards numbered 3 , 5 , 7 and 9 respectively. Find the probability that the product of the numbers drawn is greater than 35 .

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

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

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

D. $\frac{3}{8}$

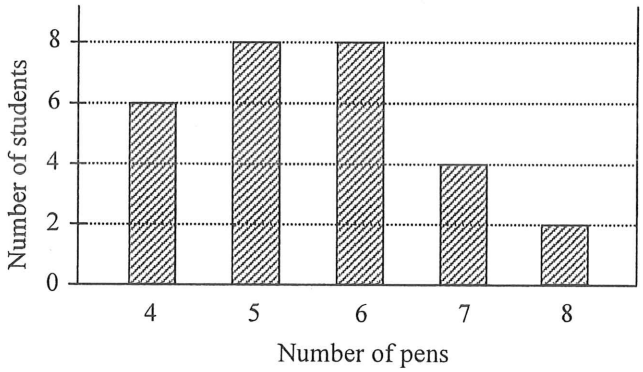
29. The bar chart below shows the distribution of the numbers of pens owned by some students. Find the inter-quartile range of the distribution.

A. 1

B. 2

C. 4

D. 6



30. Consider the following integers:

3 3 8 8 8 10 12 m n

Let x , y and z be the median, the mean and the mode of the above integers respectively. If the range of the above integers is 9 , which of the following must be true?

I. $x = 8$
II. $y = 8$
III. $z = 8$

A. I only

B. II only

C. I and III only

D. II and III only

Section B

31. $B000000000000030_{16} =$

A. $10\times 2^{60}+48$.

B. $11\times 2^{60}+48$.

C. $10\times 2^{64}+768$.

D. $11\times 2^{64}+768$.

32. If the roots of the equation $(\log_\pi x)^2-10\log_\pi x+24=\log_\pi x$ are α and β, then $\alpha\beta =$

A. π^{10} .

B. π^{11} .

C. $\log_\pi 10$.

D. $\log_\pi 11$.

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 the graph of $y=a^x$ is the reflection image of the graph of $y=b^x$ with respect to the y-axis, which of the following are true?

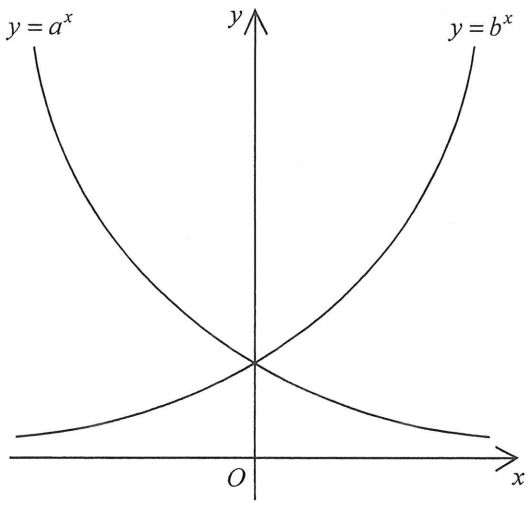
I. $a<1$
II. $b>1$
III. $ab=1$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



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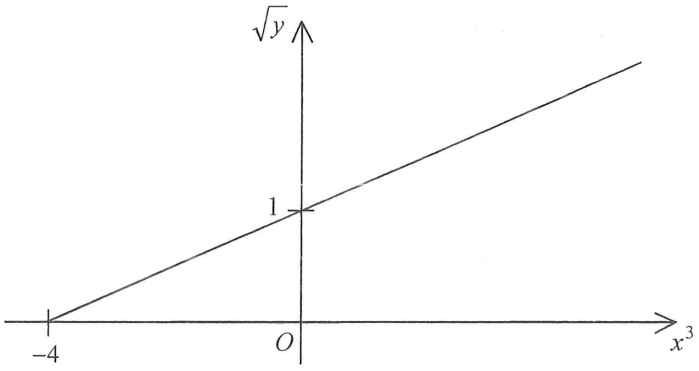
34. The graph in the figure shows the linear relation between x^3 and $\sqrt{y}$. If $x=2$, then $y=$

A. 3.

B. 8.

C. 9.

D. 33.



35. If $a>0$, which of the following are arithmetic sequences?

I. $\log a^{-3}, \log a, \log a^5$

II. $8-4a, 9-5a, 10-6a$

III. $\cos(90-a)°, \cos 90°, \cos(90+a)°$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

36. Consider the following system of inequalities:

$$\begin{cases} 0 \le x \le 2 \\ 2x+y+3 \ge 0 \\ x+y+1 \le 0 \end{cases}$$

Let D be the region which represents the solution of the above system of inequalities. Find the constant k such that the least value of $4x+3y+k$ is 24, where (x, y) is a point lying in D.

A. 25

B. 27

C. 37

D. 53

37. Define $z_1 = \dfrac{2+ki}{1+i}$ and $z_2 = \dfrac{k+5i}{2-i}$, where k is a real number. If the imaginary part of z_1 is equal to the imaginary part of z_2, then $z_1 - z_2 =$

A. -20.

B. 0.

C. 3.

D. 10.

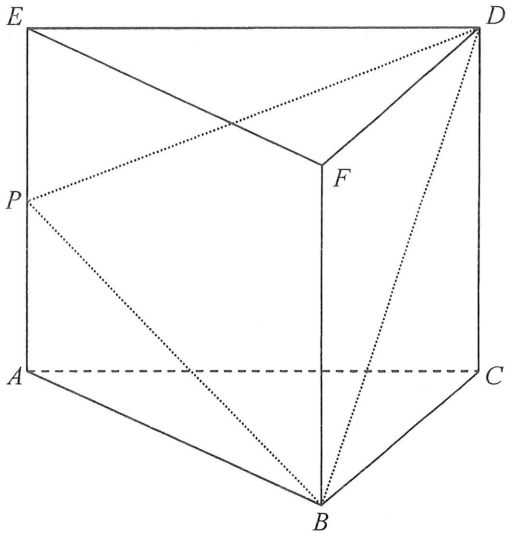
38. In the figure, $ABCDEF$ is a right triangular prism. P is a point lying on AE. If $AB = AC = 12$ cm, $AP = 9$ cm, $EP = 5$ cm and $BD = 2k$ cm, find the area of ΔBDP.

A. $\sqrt{(k^2-1)(196-k^2)}$ cm^2

B. $\sqrt{(k^2-1)(196+k^2)}$ cm^2

C. $\sqrt{(k^2+1)(196-k^2)}$ cm^2

D. $\sqrt{(k^2+1)(196+k^2)}$ cm^2



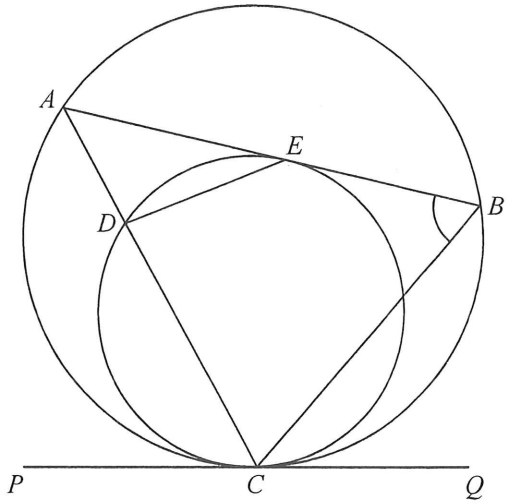
39. In the figure, ABC and CDE are circles such that ADC is a straight line. PQ is the common tangent to the two circles at C. AB is the tangent to the circle CDE at E. If $\angle ADE = 100°$ and $\angle BCQ = 35°$, then $\angle ABC =$

A. $55°$.

B. $65°$.

C. $70°$.

D. $80°$.



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40. The equations of the three sides of a triangle are $4x+3y=24$, $4x-3y=24$ and $x=a$, where a is a constant. If the x-coordinate of the in-centre of the triangle is 31, then $a=$

A. 15.

B. 31.

C. 45.

D. 51.

41. Find the range of values of c such that the circle $x^2+y^2-6x+cy-7=0$ and the straight line $x-y+9=0$ intersect.

A. $-56 \le c \le 8$

B. $-8 \le c \le 56$

C. $c \le -56$ or $c \ge 8$

D. $c \le -8$ or $c \ge 56$

42. A queue is formed by 6 boys and 5 girls. If no boys are next to each other, how many different queues can be formed?

A. 86 400

B. 172 800

C. 213 444

D. 39 916 800

43. There are 8 Chinese books and 7 English books in a box. If 5 books are randomly chosen from the box at the same time, find the probability that at most 3 Chinese books are chosen.

A. $\frac{2}{11}$

B. $\frac{9}{11}$

C. $\frac{61}{143}$

D. $\frac{82}{143}$

44. In a test, the difference of the test scores and the difference of the standard scores of two students are 30 marks and 6 respectively. In the test, the standard deviation of the test scores is

A. 5 marks.

B. 24 marks.

C. 25 marks.

D. 36 marks.

45. The variance of the six numbers $20a+3$, $20a+5$, $20a+9$, $20a+11$, $20a+15$ and $20a+17$ is

A. 5 .

B. 10 .

C. 25 .

D. $20a+25$.

END OF PAPER