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EXAMINATION NATIONAL SENIOR CERTIFICATE	
GRADE	12
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SUBJECT	MATHEMATICS
PAPER	2
MARK TOTAL	150
DURATION (HOURS)	3
NUMBER OF PAGES	27



SOUTH AFRICAN COMPREHENSIVE ASSESSMENT INSTITUTE
SUID-AFRIKAANSE KOMPREENSIEWE ASSESSERINGSINSTITUUT

QUESTION 1

To promote blood donation a blood donor centre was established at a shopping centre. The table provided below displays the daily count of blood units donated in TEN days by the people at the shopping centre.

Days	1	2	3	4	5	6	7	8	9	10
Units of blood	45	59	65	73	79	85	91	99	101	110

- 1.1.1 Calculate the mean of the units of blood donated per day over the period of 10 days. (2)

- 1.1.2 Determine the standard deviation of the data. (2)

- 1.1.3 How many days was the number of units of blood donated at the shopping centre outside one standard deviation from the mean? (3)



- 1.2.1 Draw a box and whisker diagram to represent the number of units of blood donated by people at the shopping centre. (3)

- 1.2.2 Describe the skewness of the data. Motivate your answer. (2)

[12]

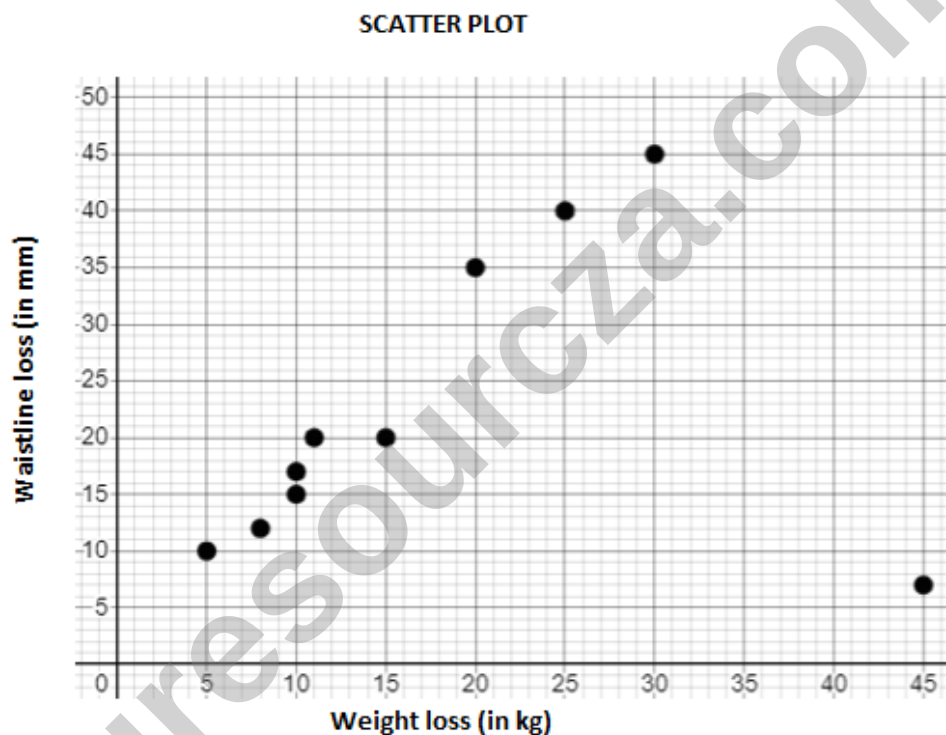


QUESTION 2

The table below represents the weight loss and waistline loss of 10 contestants who took part in a weight loss competition.

Weight loss (in kg) (x)	5	10	45	8	10	15	25	30	11	20
Waistline loss (in mm) (y)	10	15	7	12	17	20	40	45	20	35

A scatter plot of the above results is shown below.



- 2.1 Identify an outlier in the data above. (1)

- 2.2 Determine the equation of the least squares regression line for the data. (2)



- 2.3 If a contestant lost 21,2 kg during the same time. Predict the waistline loss of this contestant, correct to two decimal places. (2)

- 2.4 Draw the least square regression line on the scatter plot **provided above**. (3)

[8]

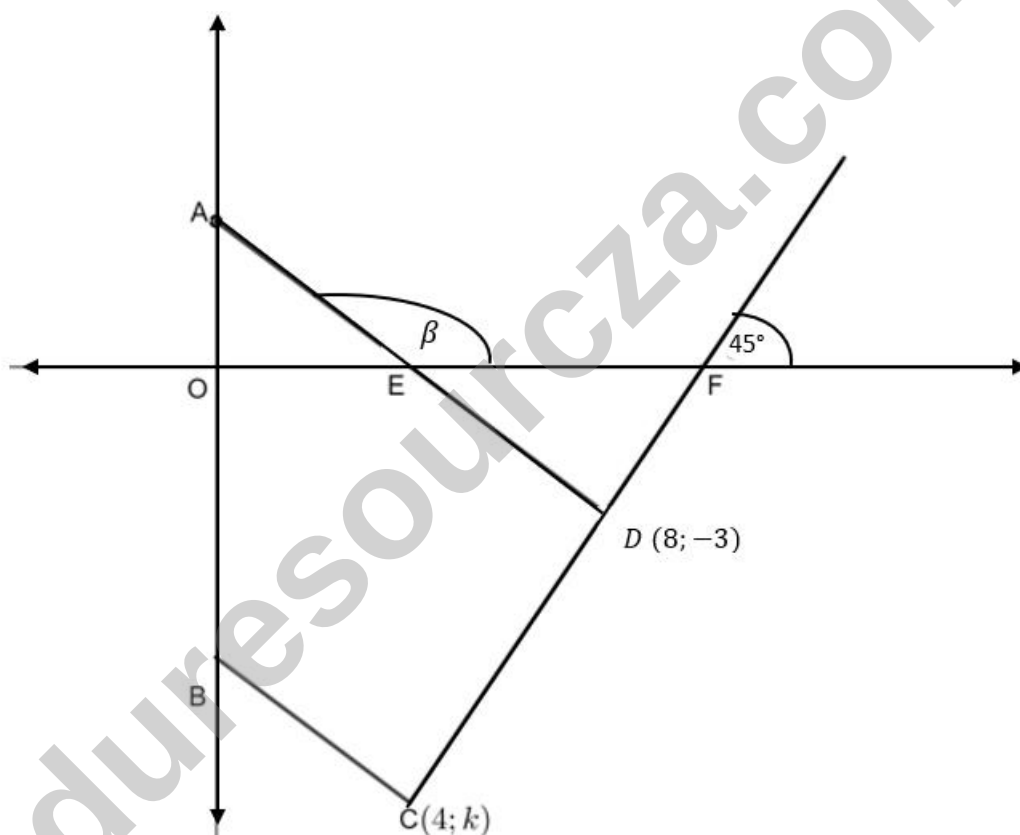
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QUESTION 3

In the diagram below:

- AD is a straight line with the equation $y = -\frac{3}{4}x + 3$.
- E and A are the x – and y –intercepts respectively of AD .
- The angle of inclination of AD is β .
- From $C(4; k)$ a line, parallel to AD is drawn that intersects the y –axes at B .
- Line CD is drawn through $D(8; -3)$ and intersects the x -axis at F .
- The angle of inclination of CD is 45° .



3.1 Determine the coordinates of A and E.

(4)



3.2 Show that $k = -7$.

(3)

3.3 Determine the equation of BC.

(3)

3.4 Determine whether $\triangle DEF$ is right-angled. Show all your calculations.

(4)



3.5 Calculate the area of $\triangle DEF$.

(5)

3.6 Let G be a point in the fourth quadrant such that CEDG forms a parallelogram. Calculate the coordinates of G.

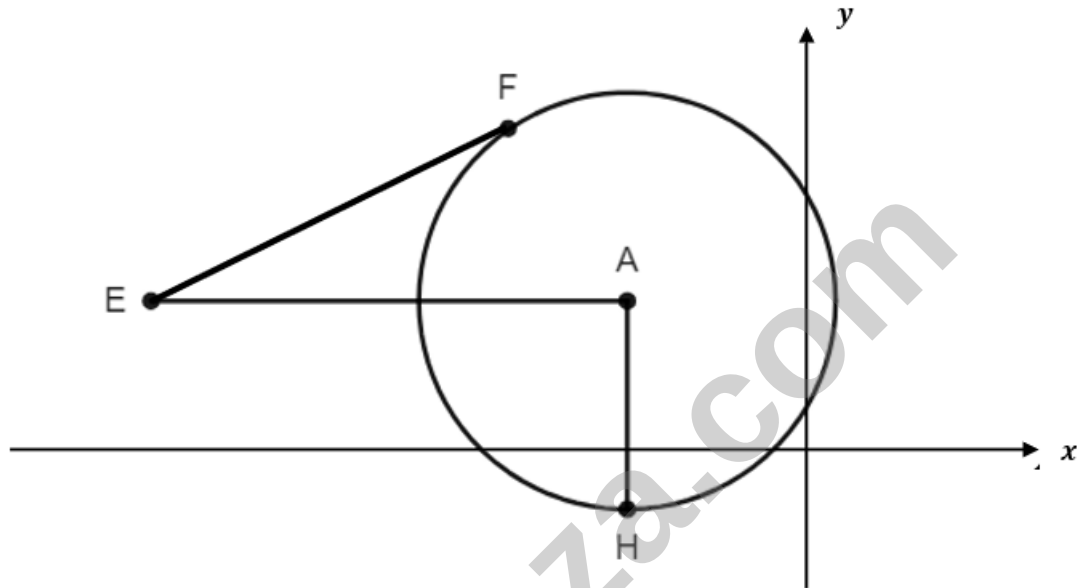
(4)

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QUESTION 4

In the diagram circle with centre A and equation $x^2 + y^2 + 12x - 10y = -12$ is given. AE is parallel to the x-axes and AH is perpendicular to the x-axes. EF is a tangent to the circle such that $EF = \sqrt{95}$.



- 4.1 Determine the coordinates of A and the radius of the circle. (5)

- 4.2 Determine the equation of the tangent to the circle at point H. (1)



4.3 Determine the coordinates of E.

(3)

4.4 Calculate the size of $\hat{FEA}$.

(2)

4.5 A circle with centre B and represented by the equation $(x + 10)^2 + (y - 5)^2 = k$, touches circle A internally.
Calculate the value of k .

(2)



- 4.6 Circle A is reflected about the x-axis and translated 2 units to the right to form a new circle with centre P.
Write down the equation of circle P. (2)

[15]

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QUESTION 5

5.1 If $17 \cos \theta = -8$ and $0^\circ < \theta < 180^\circ$, calculate, **without the use of a calculator**:

5.1.1 $\tan(360^\circ - \theta)$ (3)

5.1.2 $\sin 2\theta$. (3)

5.1.3 $\sin(810^\circ - \theta)$. (3)



- 5.2 Express the following as a single trigonometric ratio. **The use of a calculator is not allowed.**

$$\frac{2}{\sin(30^\circ + x) \cos x - \cos(30^\circ + x) \sin x} \times \frac{\sin(138^\circ) \cdot \sin(48^\circ)}{1 - 2 \sin^2 318^\circ} \quad (7)$$

- 5.3 Given:

$$\frac{2 \sin 2x - \cos^2 x - \sin^2 x + \cos 2x}{2 \cos x - \sin x} = 2 \sin x$$

- 5.3.1 For which value(s) of x is the identity undefined? (4)



5.3.2 Prove the identity completely.

(5)

5.3.3 Hence, or otherwise, determine the value(s) of x such that

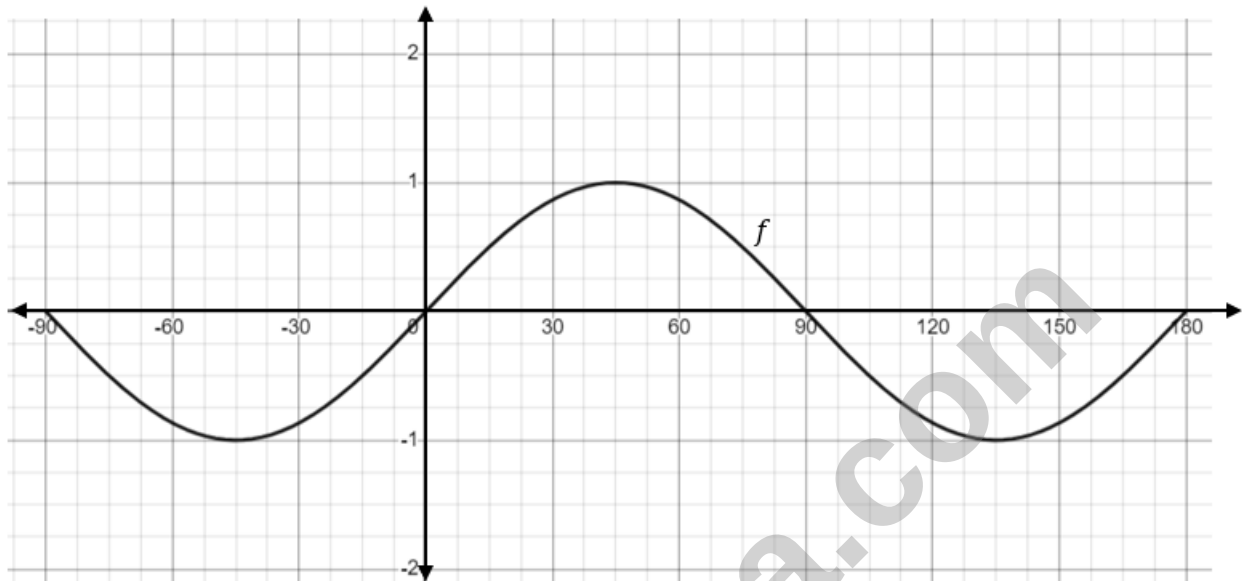
$$2 \sin 2x - \cos^2 x - \sin^2 x + \cos 2x = 4 \cos x - 2 \sin x, \quad \text{if } x \in [-360^\circ; 360^\circ] \quad (4)$$

[29]



QUESTION 6

The diagram below shows the graph of $f(x) = \sin 2x$, where $x \in [-90^\circ; 180^\circ]$.



- 6.1 Sketch the graph of $g(x) = \cos(x + 30^\circ)$ on the same system of axes above for $x \in [-90^\circ; 180^\circ]$. (4)
- 6.2 Determine the x -value(s) for the points of intersection of f and g , if $x \in [-90^\circ; 180^\circ]$. (4)



6.3 Use your graph and the value(s) calculated in 6.1 and determine the value(s) of x such that:

6.3.1 $f'(x) = 0$, if $x > 0$ (2)

6.3.2 $\sin x \cos x > \frac{1}{2} \cos(x + 30^\circ)$ (5)

[15]

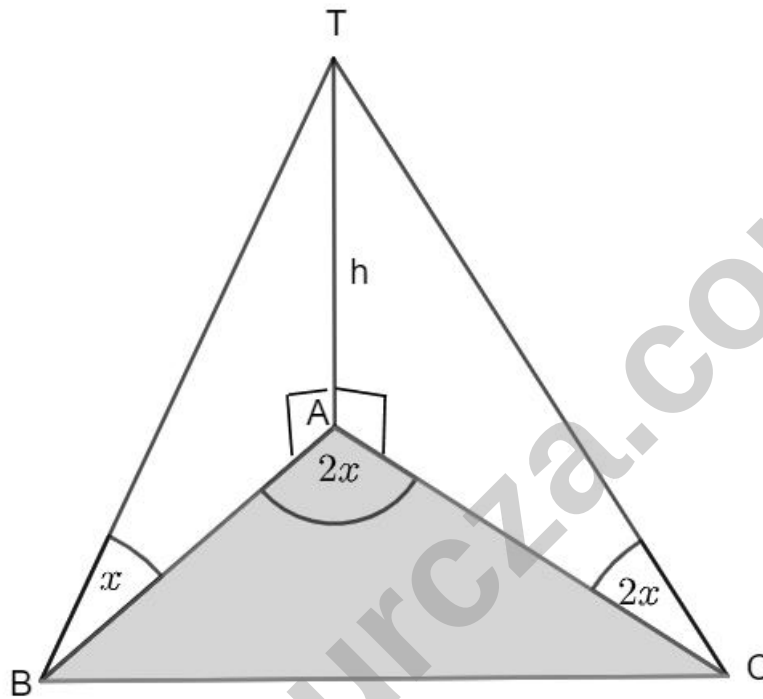


QUESTION 7

In the diagram AT is a vertical tower.

A, B and C lie in the same horizontal plane. The angle of elevation to the top of the tower from B is x and the angle of elevation to the top of the tower from C is $2x$.

$\angle BAC = 2x$.



7.1 Express AC and AB in terms of x and h .

(3)



7.2 Hence, prove that $\text{Area } \Delta ABC = \frac{h^2 \cos 2x}{2 \tan x}$ (4)

7.3 Determine the area of ΔABC if $h = 12$ and $x = 32^\circ$. (2)

[9]

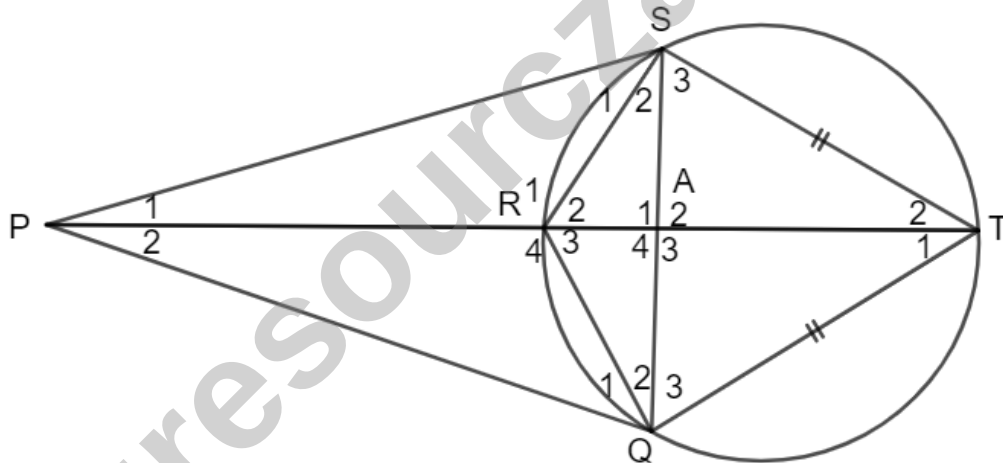
QUESTION 8

- 8.1 Complete the following statement correctly:
The angle between a tangent to a circle and a chord drawn from the point of contact is . . .

(2)

- 8.2 In the diagram:

- Q, R, S and T lie on the circumference of the circle.
- $ST = QT$.
- PS and PQ are tangents to the circle at S and Q respectively.
- PRAT is a straight line and intersects straight line SQ in A.



- 8.2.1 Give a reason why $\angle PSQ = \angle PQS$.

(2)



8.2.2 Prove that $Q\hat{R}S = 2\hat{S}_3$.

(3)

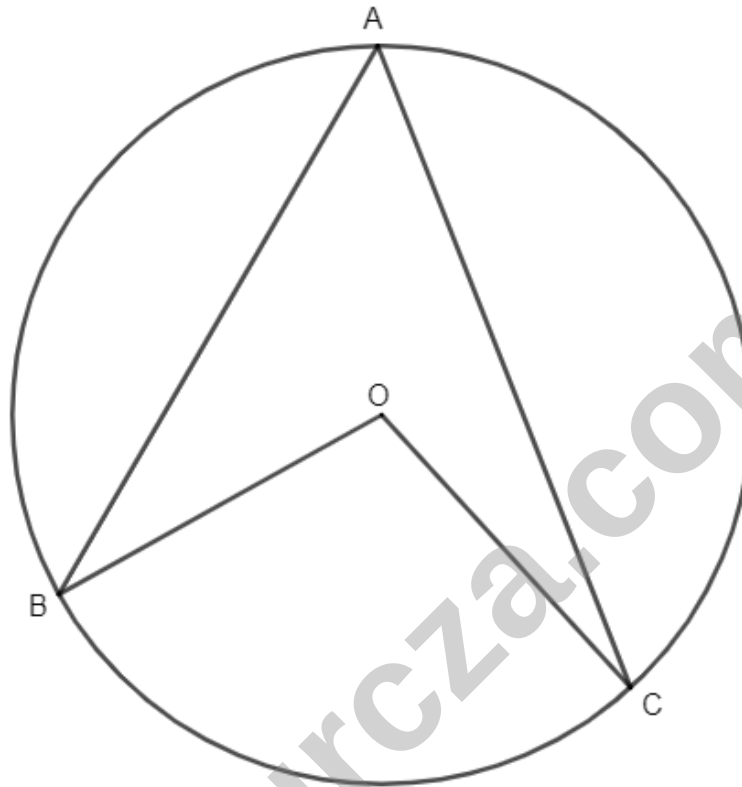
[7]

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QUESTION 9

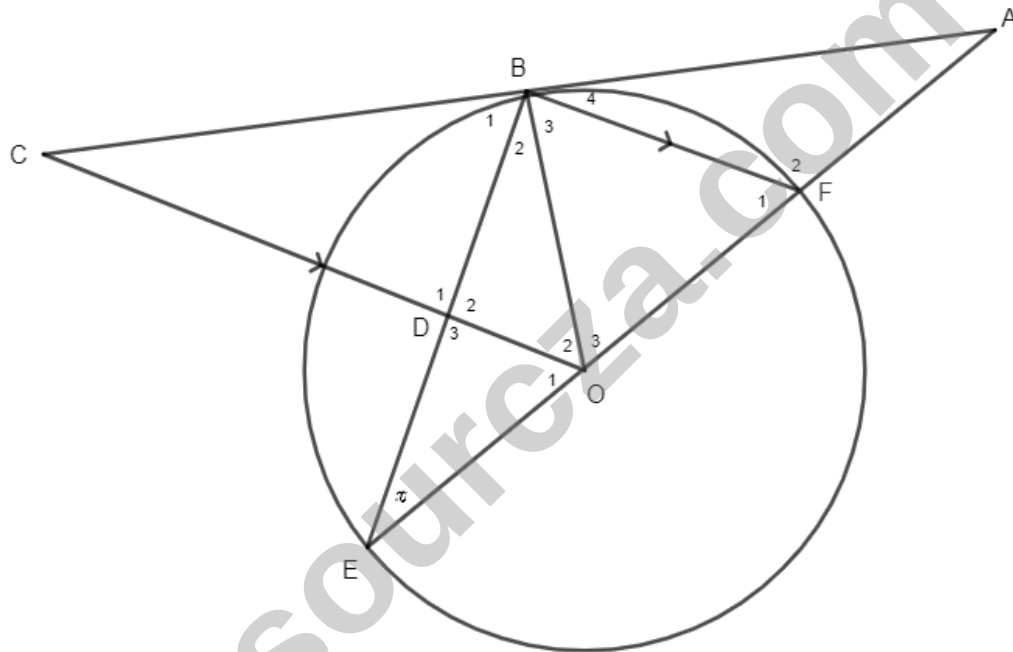
- 9.1 Use the given diagram to prove that $\angle BOC = 2\angle BAC$. (5)





9.2 In the diagram:

- O is the centre of the circle.
- EF, the diameter of the circle is extended to A.
- ABC is a tangent to the circle at B.
- $CO \parallel BF$.
- $\hat{E} = x$.



9.2.1 State, with reasons, THREE other angles equal to x .

(3)

[illegible]



9.2.2 Determine, with reasons, $\hat{O}_3$ in terms of x .

(2)

9.2.3 Prove that D is the midpoint of BE.

(4)

9.2.4 Prove that BOEC is a cyclic quadrilateral.

(2)



9.2.5 Prove that $\triangle ABF \parallel \triangle AEB$.

(3)

9.2.6 Prove that $2ED \cdot AB = AE \cdot BF$.

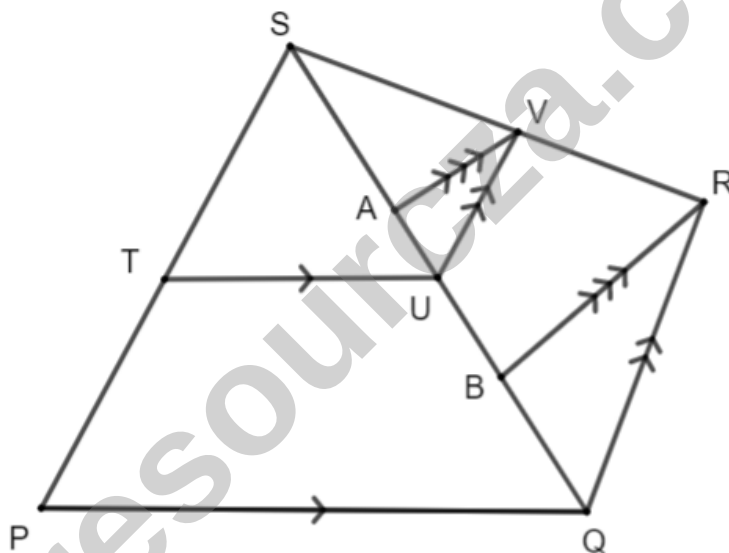
(3)

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QUESTION 10

In the diagram $\triangle SPQ$ and $\triangle SQR$ are given:

- T lies on SP and U on SQ with $TU \parallel PQ$.
- V lies on SR with $UV \parallel QR$.
- A and B lie on SQ with $AV \parallel BR$.
- $SP = 14$ units.
- $ST = 8$ units.
- B is the midpoint of UQ.



10.1 Determine, with reasons, the ratio of $SV : VR$.

(4)



10.2 Determine, with reasons, the ratio of $BR : AV$.

(3)

10.3 Show that $8UB = 3SU$.

(3)

[10]

GRAND TOTAL: [150]

**INFORMATION SHEET: MATHEMATICS**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2}[2a + (n - 1)d]$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1} ; \quad r \neq 1$$

$$S_\infty = \frac{a}{1 - r} ; \quad -1 < r < 1$$

$$F = \frac{x[(1 + i)^n - 1]}{i}$$

$$P = \frac{x[1 - (1 + i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \quad a^2 = b^2 + c^2 - 2bc \cdot \cos A \quad \text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2 \sin \alpha \cdot \cos \alpha$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$