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ST STITHIANS GIRLS' COLLEGE

Departments of Mathematics

GRADE 12	
PRELIMINARY EXAMINATION – PAPER 2	
DATE: September 2022	TIME: 3 hours
TOTAL MARKS: 150	
EXAMINER: Girls' College	MODERATOR: Boys' College

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1. This question paper consists of 16 questions and 24 pages.
2. A separate information (formula) sheet will be provided to you.
3. Answer all the questions and clearly show ALL calculations you have used to determine your answers. Answers only will NOT necessarily be awarded full marks.
4. You may use an approved scientific calculator (non-programmable and non-graphical) unless specified otherwise.
5. If necessary, round off answers to ONE decimal places, unless stated otherwise.
6. Please note that diagrams are not drawn to scale.
7. It is in your own interest to write legibly and to present your work neatly.
8. PLEASE FILL IN YOUR NAME AND CIRCLE YOUR TEACHER'S NAME ON THE BACK PAGE.

Question 1

A biologist looks at the relationship between the amount of fertilizer supplied (in *grams*) to a tomato plant weekly and the subsequent yield of tomatoes (in *kilograms*) obtained.

Fertilizer in <i>grams</i> (<i>x</i>)	1,0	1,5	2,0	2,5	3,0	3,5	4,0	4,5
Yield in <i>kilograms</i> (<i>y</i>)	3,9	4,4	5,8	6,6	7,0	7,1	7,3	7,7

- (a) Determine the correlation coefficient and describe the correlation between fertilizer supplied and yield of tomatoes to three decimal places. (3)
- (b) Determine the equation of the regression line which best fits the given data. Round off your answers to three decimal places. (3)
- (c) Estimate the yield of tomatoes when 3,2 g of fertilizer is supplied weekly. (2)
- (d) If 5,5 kg of fertilizer was supplied weekly, can you accurately predict the yield of tomatoes. Justify your answer. (2)

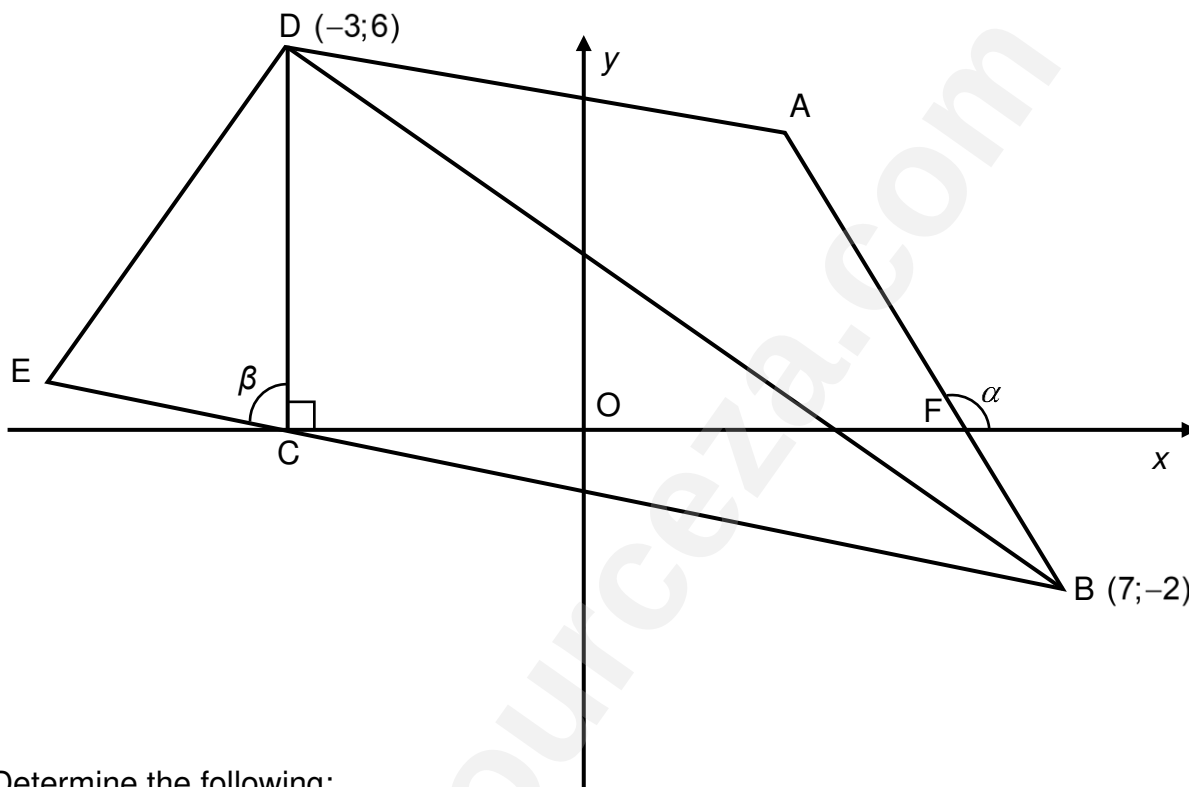
[10]

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Question 2

In the diagram A, B (7; -2), C and D (-3; 6) are vertices of a quadrilateral. F is a point on the x -axis. BC is produced to E. DE is drawn. $\alpha = 108,43^\circ$ is the angle created by the x -axis and line AF, $\hat{DCE} = \beta$ and $CD \perp x$ -axis.



Determine the following:

- (a) The coordinates of C. (1)
- (b) Show that the gradient of AB is -3 correct to the nearest integer. (2)
- (c) The equation of AB in the form $y = mx + c$. (2)

(d) (1) The angle of inclination of BE. (3)

(2) Hence, determine β . (2)

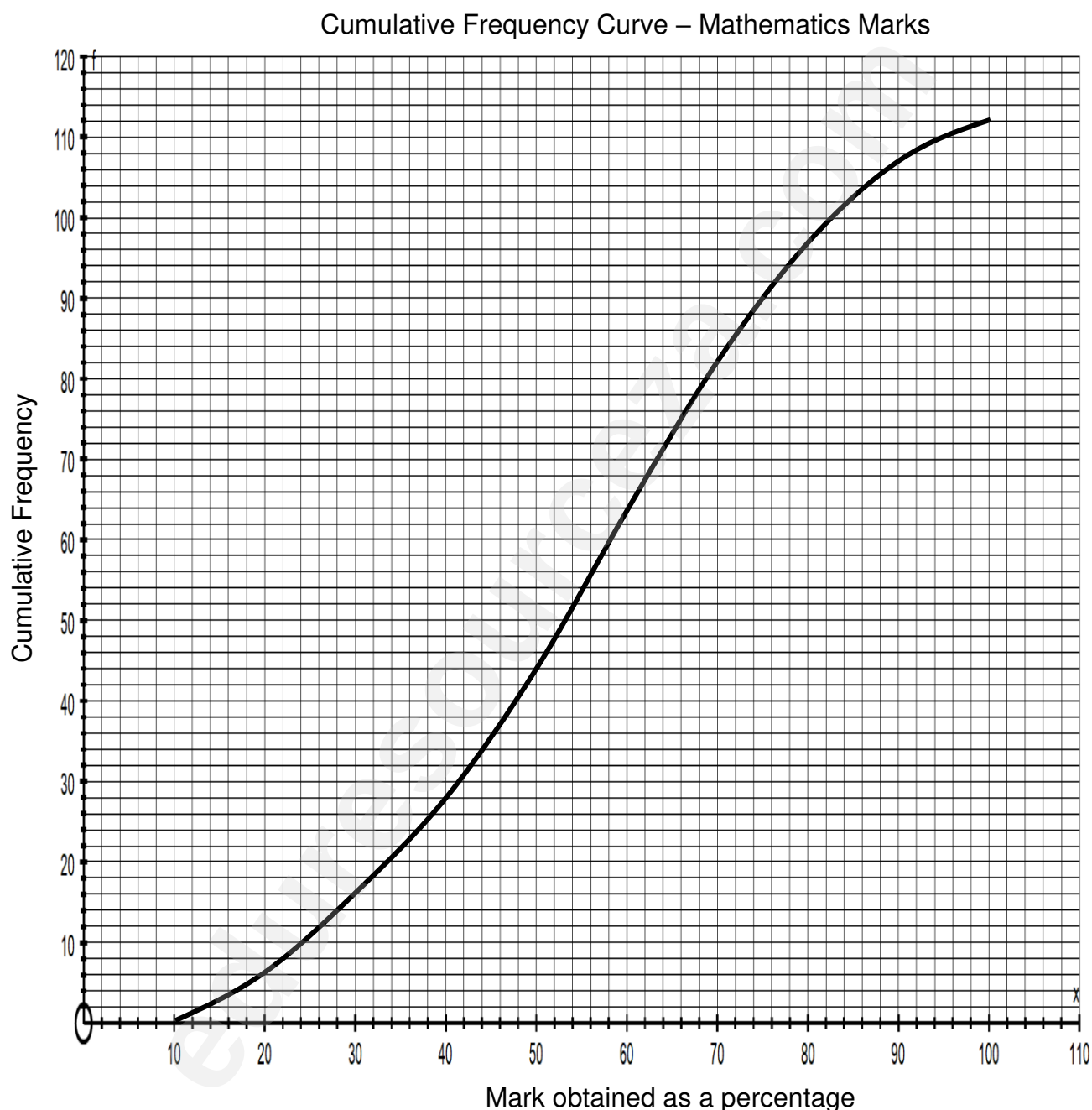
(e) The length of BC. (2)

(f) If $BC = 3EC$, determine the area of $\triangle CDE$. (4)

[16]

Question 3

The cumulative frequency curve below shows the marks as a percentage obtained in a Mathematics examination.



- (a) How many students wrote the Mathematics examination? (1)
- (b) What was the lowest possible mark obtained in the examination? (1)

- (c) Complete the table:

	Frequency
$0 \leq x < 10$	
$10 \leq x < 20$	6
$20 \leq x < 30$	
$30 \leq x < 40$	12
$40 \leq x < 50$	
$50 \leq x < 60$	20
$60 \leq x < 70$	18
$70 \leq x < 80$	
$80 \leq x < 90$	10
$90 \leq x < 100$	5

(4)

- (d) 25% of the students failed the examination. What was the pass mark?

(2)

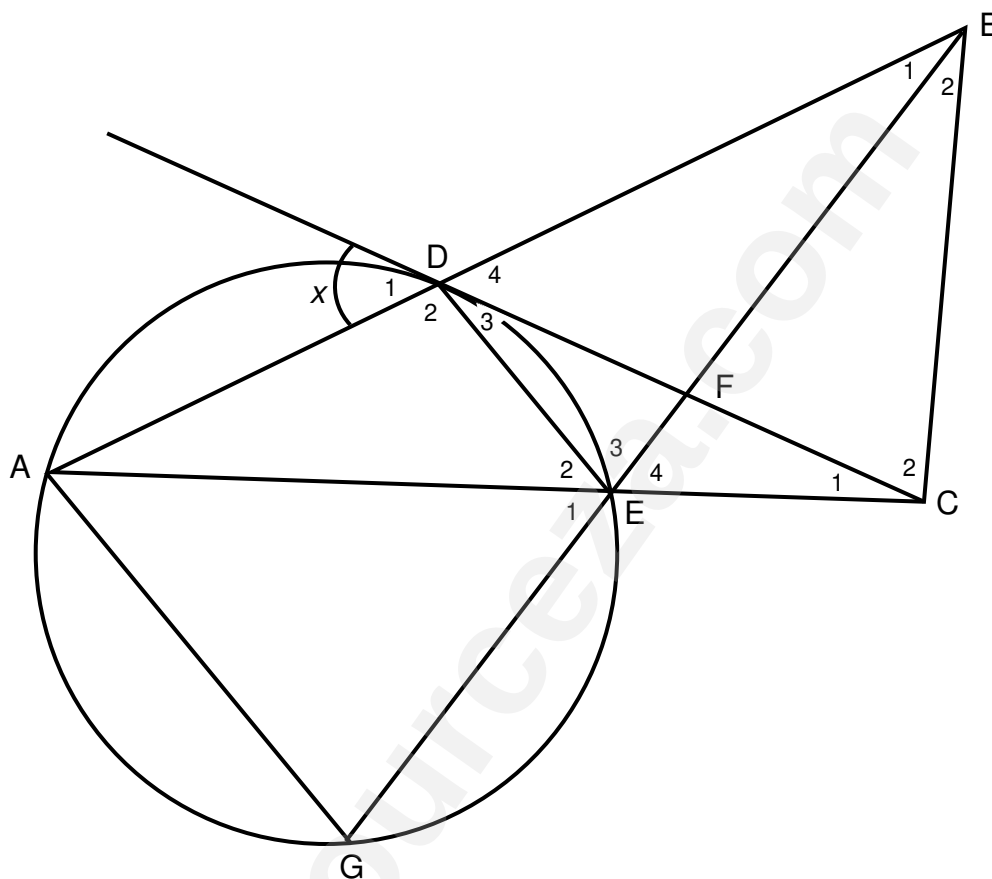
- (e) Determine the interquartile range of the data.

(3)

[11]

Question 4

DC is a tangent to the circle at D. Lines AD and AE are produced to B and C respectively.
 $DE = EC$, $\hat{E}_1 = \hat{E}_2$ and $\hat{D}_1 = x$.



Answer the following stating all reasons:

(a) Give 3 other angles that are equal to x . (3)

(b) (1) Prove BCED is a cyclic quadrilateral. (4)

- (2) Hence, prove DE is a tangent to circle DBF at D. (4)

[11]

Question 5

Given $3\sin\theta + 4 = 3$ and $\cos\theta > 0$. Determine the following with the aid of a diagram and without the use of a calculator:

(a) $\tan\theta$ (4)

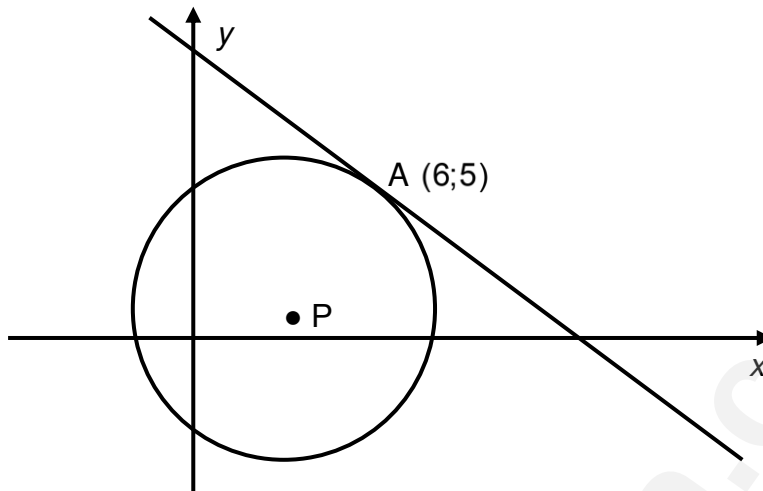
(b) $\cos 2\theta$ (3)

(c) $\sin(\theta + 60^\circ)$ (4)

[11]

Question 6

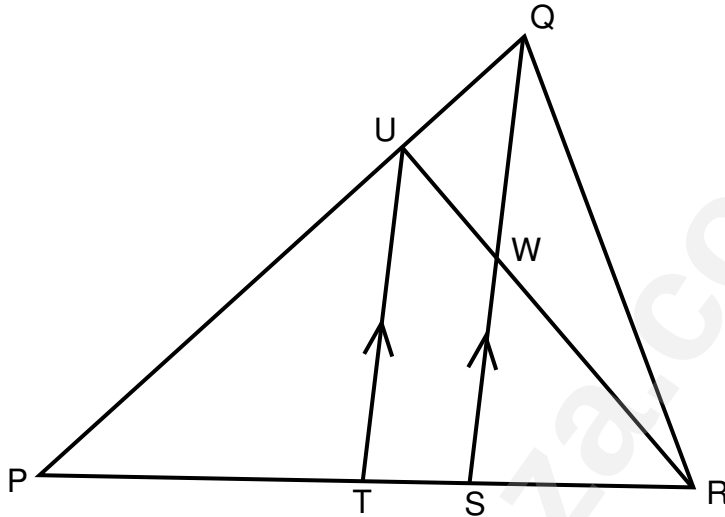
Given circle with centre P and equation $x^2 - 6x + (y - 1)^2 = 16$. A is a point on the circle.



- (a) Determine the radius and coordinates of the centre of the circle. (4)
- (b) Determine the equation of the tangent to the circle at A. (4)
- (c) Determine the equation of another tangent to the circle with the same gradient. (3)

Question 7

In $\triangle PQR$, T is the midpoint of PR. $TU \parallel SQ$ and $\frac{PU}{PQ} = \frac{5}{7}$. SQ and RU intersect at W.



Determine, with reasons:

(a) $\frac{TS}{SR}$ (4)

(b) RW if $RU = 20\text{cm}$ (3)

[7]

Question 8

(a) Prove that:

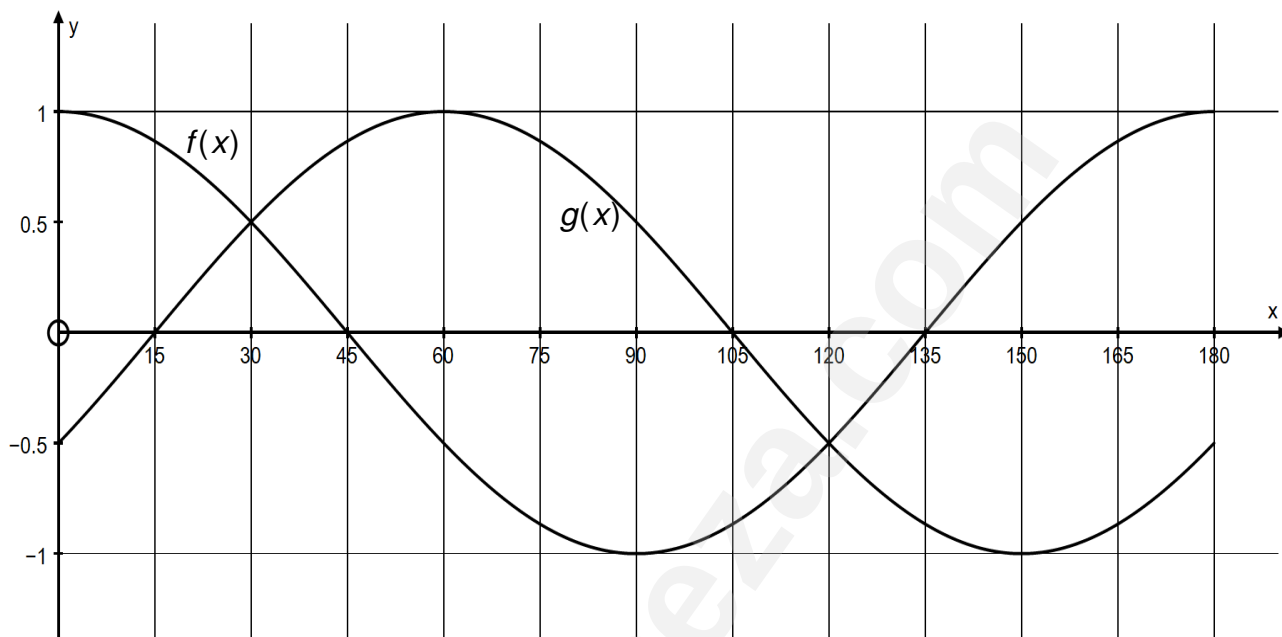
$$\tan \theta + \frac{\cos \theta}{\sin \theta} = \frac{2}{\sin 2\theta} \quad (5)$$

(b) Solve for α , given $\alpha \in (0^\circ; 360^\circ)$:

$$\cos 2\alpha + 3\cos \alpha - 1 = 0 \quad (6)$$

Question 9

Given $f(x) = \cos 2x$ and $g(x) = \sin(ax - b)$.



- (a) Determine the values of a and b . (2)
- (b) Write down the period of $f(x)$. (1)
- (c) For which values of x is $f(x) - g(x) > 0$ (2)
- (d) For which values of x is $f(x) \cdot g(x) \leq 0$ (3)

Question 10

Given:

$$\sin 37^\circ \cos 14^\circ = p$$

$$\sin 14^\circ \cos 37^\circ = q$$

$$\cos 37^\circ \cos 14^\circ = r$$

$$\sin 37^\circ \sin 14^\circ = s$$

Express each of the following in terms of p , q , r , s . Show all working.

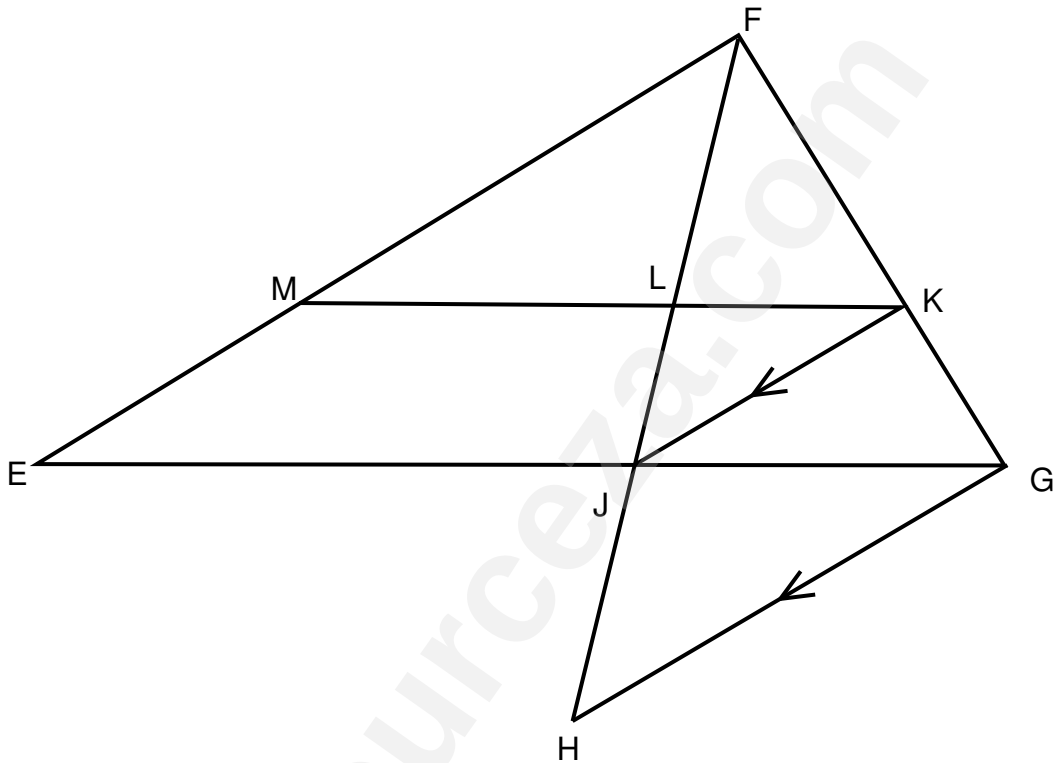
(a) $\sin 51^\circ$ (2)

(b) $\cos 23^\circ$ (2)

[4]

Question 11

The sketch below shows $\triangle EFG$. $\hat{E}FG = 15x$, $\hat{F}GE = 16x$ and $\hat{E} = 5x$.
 $FM:ME = 3:2$ and $FK:FG = 3:5$. FJ is extended to H .
 $JK \parallel HG$ and $JH = 6 \text{ units}$.



Determine, with reasons:

- (a) The value of x . (3)
- (b) The size of $\hat{FMK}$. (5)

(c) The ratio of $\frac{FJ}{JH}$. (2)

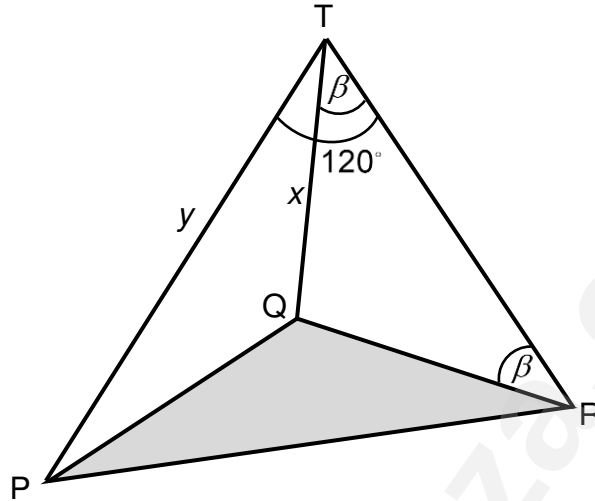
(d) The length of FL. (4)

[14]

Question 12

P, Q and R are points on the base of a pyramid. $TQ = x$ is an almost vertical side of the pyramid. $\hat{QTR} = \beta$, which is also the same size as the angle of elevation of T from R.

$PT = y$ and $\hat{PTR} = 120^\circ$.



- (a) Show that $TR = 2x \cos \beta$ (3)

- (b) Hence, show that $PR = \sqrt{y^2 + 4x^2 \cos^2 \beta + 2xy \cos \beta}$ (3)

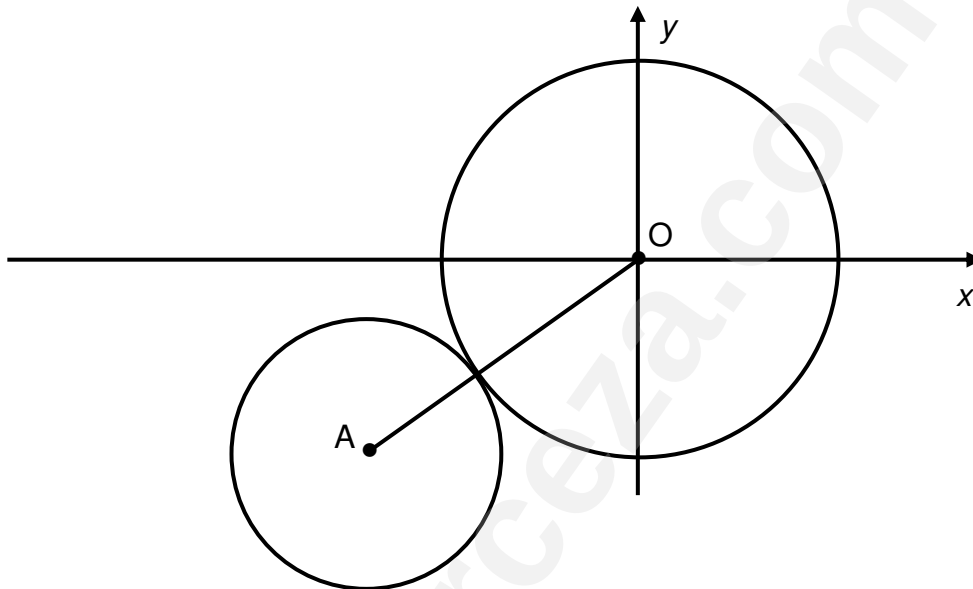
[6]

Question 13

In the diagram below, two circles are drawn. Circle centre O touches circle centre A.

The equation of circle O is given by $x^2 + y^2 = 59$

The equation of the circle centre A is given by $(x - 2z)^2 + (y - z)^2 = 33$



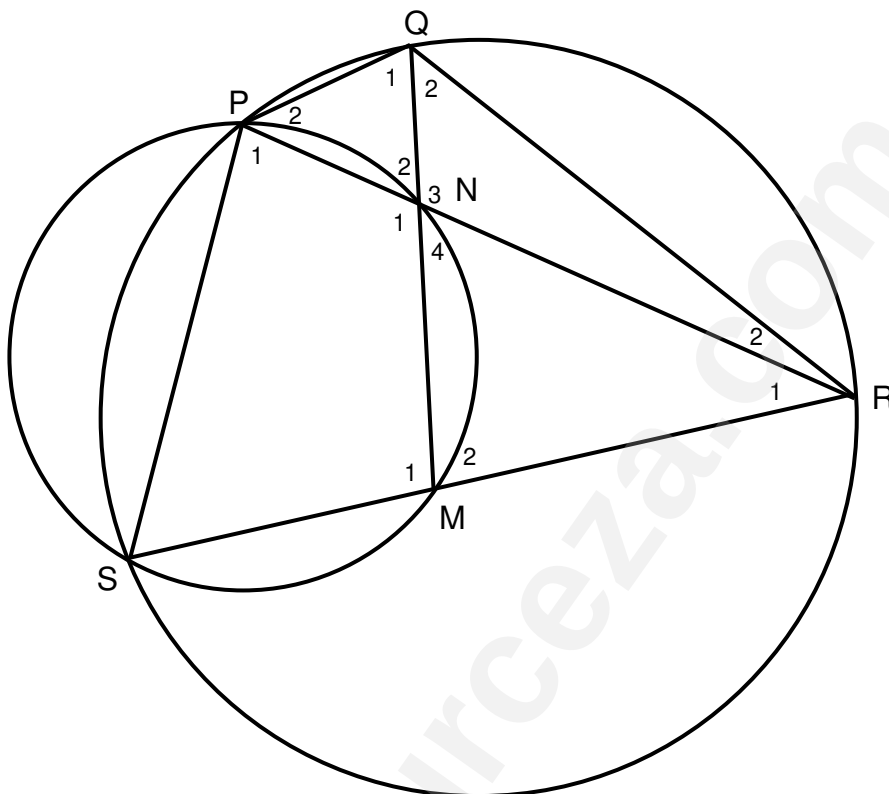
Determine the value of z .

(5)

[5]

Question 14

Two circles intersect at P and S. Chords PR and RS meet the smaller circle at N and M respectively. MN produced meets the larger circle at Q. PQ and QR are drawn.



Prove the following, with reasons:

(a) $\hat{Q}_1 + \hat{Q}_2 = \hat{N}_3$

(4)

(b) $\triangle QRN \parallel \triangle PRQ$

(3)

(c) $QR^2 = SR \cdot MR$

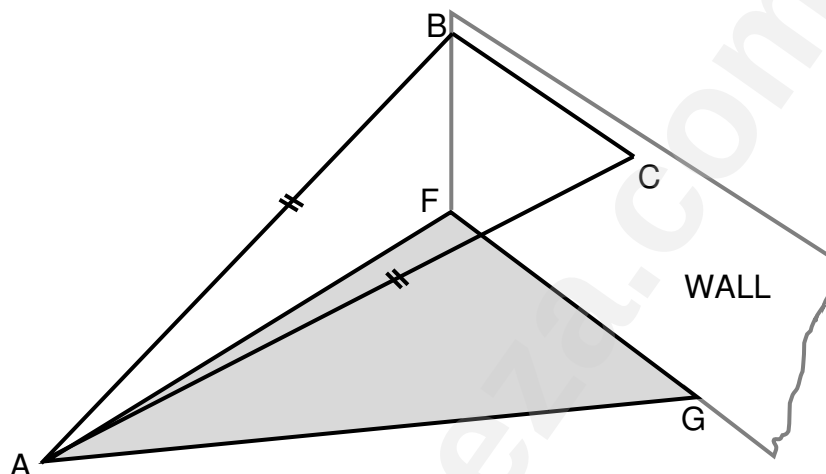
(6)

[13]

Question 15

An isosceles triangle shade cloth ABC is installed to create shade. It is attached to the ground at A and attached to a wall at B and C. BC has a length of 8 m and $\hat{BAC} = 50^\circ$. The angle of elevation $\hat{FAB} = 30^\circ$ and $\angle AFG = 100^\circ$. At a certain time in the day, the shadow cast by the tent is shown by $\triangle AFG$, where point G is 15 m from F. Determine the area of the shadow cast by the shade cloth.

(7)



[7]

Question 16

Prove the radius of a circle with equation $x^2 + y^2 + (4\cos\theta)x + (8\sin\theta)y + 3 = 0$ can never exceed $\sqrt{13}$ for any value of θ .

(5)

[5]

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MARK RECORD SHEET**Name:** _____

Teacher: Mrs Kaur ☐ Mrs Marais ☐
 Mr Schaerer ☐ Mrs Smith ☐

Question	Analytical Geometry	Euclidean Geometry & Measurement	Statistics	Trigonometry
1			/10	
2	/16			
3			/11	
4		/12		
5				/11
6	/10			
7		/7		
8				/11
9				/8
10				/4
11		/14		
12				/6
13	/5			
14		/13		
15				/7
16	/5			
TOTAL	/ 37	/ 45	/ 21	/ 47
TOTAL	/ 150		%	