

**YEAR 11
MATHEMATICS
SPECIALIST**

**Test 2, 2023
Calculator Allowed
Geometric Proofs & Vectors II**

STUDENT'S NAME: _____

DATE: Monday 8th May

TIME: 50 minutes

MARKS: 50

ASSESSMENT %: 10

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

Special Items: 1 A4 page notes, Classpad, Scientific Calculator

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

Question 1

(5 marks)

Determine, giving answers to one decimal place,

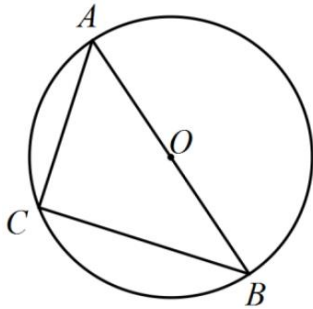
(a) the vector projection of $12\hat{i} + 37\hat{j}$ onto $75\hat{i} - 94\hat{j}$ (2 marks)

(b) the vector projection of a force of 60 N on bearing 333° onto a force of 30 N on a bearing of 115° (3 marks)

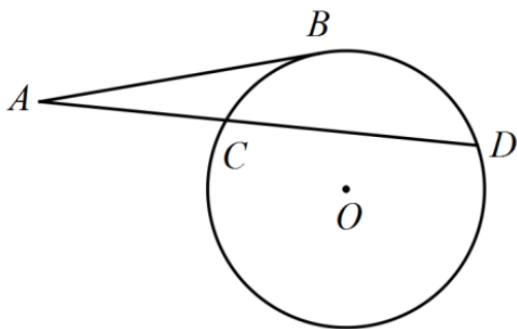
Question 2

(8 marks)

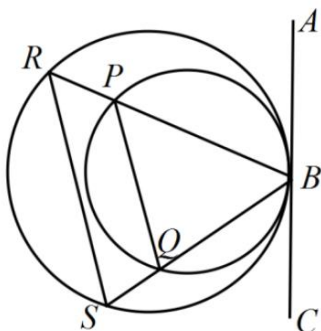
- (a) Determine, with justification, the length of the radius in the circle shown below given that $AC = 8$ cm and $BC = 15$ cm (2 marks)



- (b) Determine the length of the chord CD given that the length of the tangent AB is 15 cm and the length of the secant AD is 26 cm. (3 marks)



- (c) The line segment ABC is a common tangent to both circles shown below. Prove that PQ is parallel to RS . (3 marks)



Question 3

(8 marks)

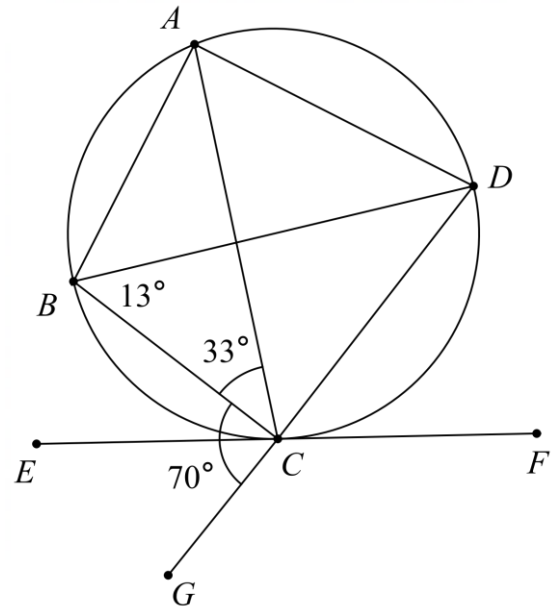
$ABCD$ is a cyclic quadrilateral.

EF is a tangent at C , and DCG is a straight line.

$$\angle BCA = 33^\circ$$

$$\angle GCB = 70^\circ$$

$$\angle DBC = 13^\circ$$



(a) Determine the following angles, giving reasons

(i) $\angle BAD$

(2 marks)

(ii) $\angle BDA$

(2 marks)

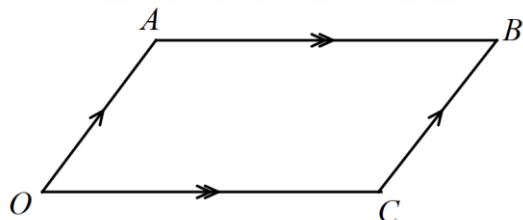
(b) Prove that AC passes through the centre of the circle, justifying your answer.

(4 marks)

Question 4

(5 marks)

Use vector methods to prove that the sum of the squares of the length of the diagonals of parallelogram $OACB$ is equal to the sum of the squares of the length of the sides.



Question 5**(6 marks)**

Consider the following true statement “if a hexagon is regular then it has six sides of equal length”

- (a) Write the contrapositive of the statement and explain whether or not the contrapositive is also true. (2 marks)
- (b) Write the inverse of the statement and explain whether or not the inverse is also true. (2 marks)
- (c) Write the converse of the statement and explain whether or not the converse is also true. (2 marks)

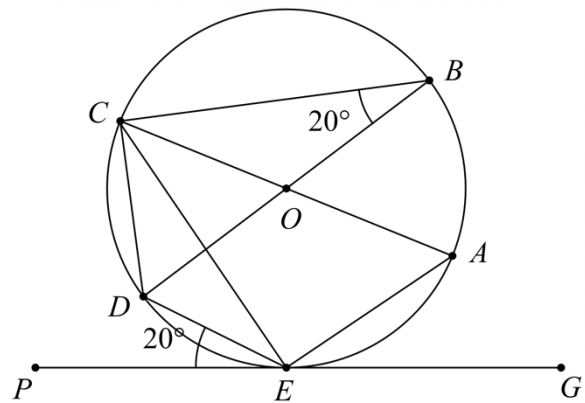
Question 6

(10 marks)

In the diagram at right, A, B, C, D and E are five points on the circle with centre O .

AC and BD are diameters, and PEG is a tangent to the circle at E .

It is given that $\angle DEP = \angle DBC = 20^\circ$.



- (a) Determine, giving reasons, the size of the following angles:
 - (i) $\angle DEC$ (1 mark)
 - (ii) $\angle DCE$ (1 mark)
- (b) Using part (a) and triangle CDE , explain why $\angle COD = \angle DOE$. (2 marks)
- (c) Prove that $\angle EAC = 40^\circ$, giving reasons. (3 marks)

- (d) Is it possible to draw a circle through the points E , O , C and D . Justify your answer. (3 marks)

Question 8

(8 marks)

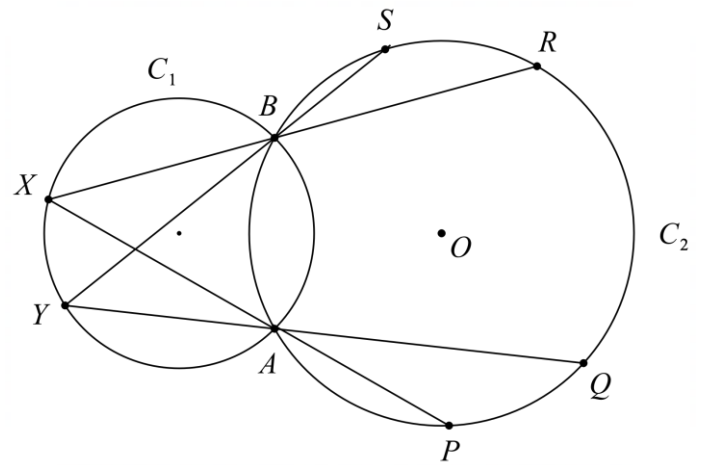
Two circles, C_1 and C_2 , intersect at A and B .

Two points X and Y are on C_1 .

The line XA extended intersects with C_2 at P , and YB extended intersects with C_2 at S .

The line XB extended intersects with C_2 at R , and YA extended intersects with C_2 at Q .

O is the centre of C_2 .



(a) Prove that $\angle PAQ = \angle SBR$, giving reasons.

(3 marks)

(b) Prove the chords PR and QS are congruent.

(5 marks)

END OF QUESTIONS

Spare working page

Question #: _____

Spare working page

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