

**Year 11 Mathematics Specialist
Test 2/3 2020**

Section 1 Calculator Free
Component Vectors & Geometric Proof

STUDENT'S NAME _____

DATE: Wednesday 13 May

TIME: 25 minutes

MARKS: 26

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

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

1. (6 marks)

Given that $\mathbf{a} = -3\mathbf{i} + 4\mathbf{j}$, $\mathbf{b} = 2\mathbf{i} + \mathbf{j}$ and $\mathbf{c} = 3\mathbf{i} - 2\mathbf{j}$ determine:

(a) a unit vector in the same direction as \mathbf{b} [2]

(b) $|\mathbf{a} + \mathbf{b} + \mathbf{c}|$ [2]

(c) a vector that is parallel to $\mathbf{a} + \mathbf{b} + \mathbf{c}$ with a magnitude of 4. [2]

2. (4 marks)

The unit vector $\mathbf{u} = a\mathbf{i} - b\mathbf{j}$ is perpendicular to $4\mathbf{i} + 3\mathbf{j}$. If $a > 0$, determine the value of a and b

3. (4 marks)

Consider the following statement:

If $ABCD$ is a parallelogram, then $\triangle ABD$ and $\triangle CBD$ are congruent.

(a) Determine the converse statement of this premise [1]

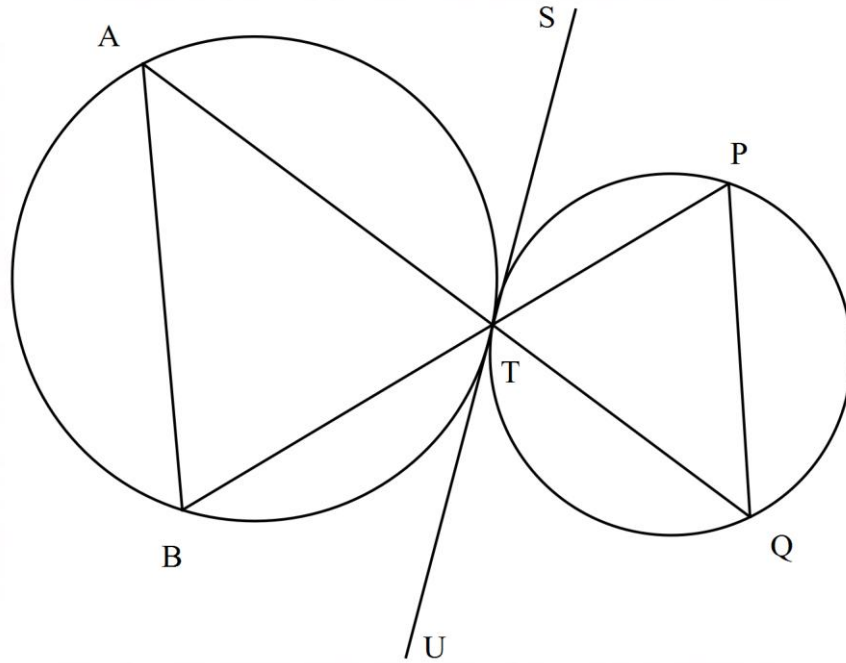
(b) (i) Determine the contrapositive statement of this premise. [1]

(ii) Is the contrapositive statement true or false? Explain. [2]

4. (5 marks)

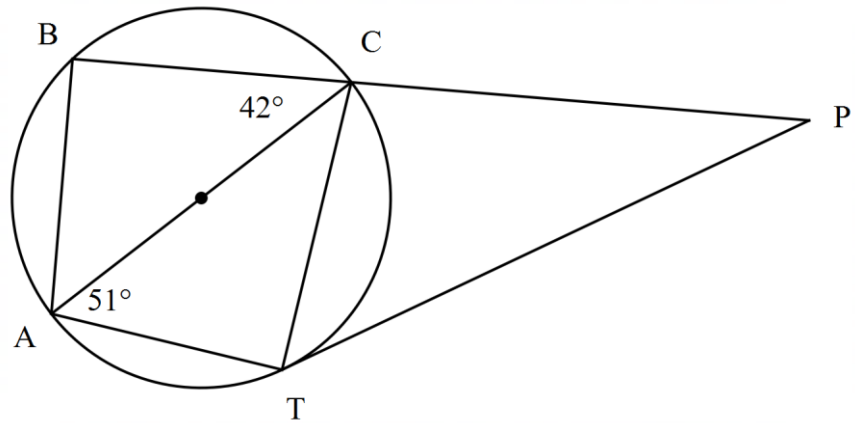
STU is a common tangent to both circles. AQ and BP are straight lines.

Prove that AB is parallel to PQ



5. (7 marks)

Consider the following diagram. PT is a tangent to the circle.



Determine, with reasons

(a) $\angle ABC$ [2]

(b) $\angle CPT$ [3]

(c) $|PT|$ if $|BC|=3$ and $|CP|=5$ [2]

**Year 11 Mathematics Specialist
Test 2/3 2020**

**Section 2 Calculator Assumed
Component Vectors & Geometric Proof**

STUDENT'S NAME _____

DATE: Wednesday 13 May

TIME: 25 minutes

MARKS: 24

INSTRUCTIONS:

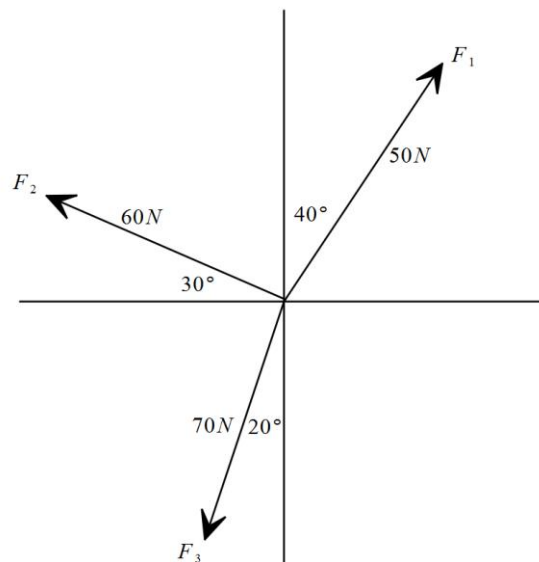
Standard Items: Pens, pencils, drawing templates, eraser

Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

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

6. (5 marks)

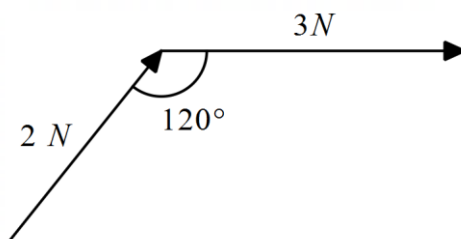
Three forces act on a body as shown in the diagram below. Determine the magnitude and direction of a single force that will keep the system in equilibrium.



7. (7 marks)

(a) Determine the scalar product for the two vectors shown.

[2]



(b) For the vectors $\mathbf{a} = -3\mathbf{i} + 4\mathbf{j}$ and $\mathbf{b} = 5\mathbf{i} + 2\mathbf{j}$ determine

(i) The vector projection of \mathbf{a} onto \mathbf{b}

[3]

(ii) The scalar projection of \mathbf{b} onto \mathbf{a}

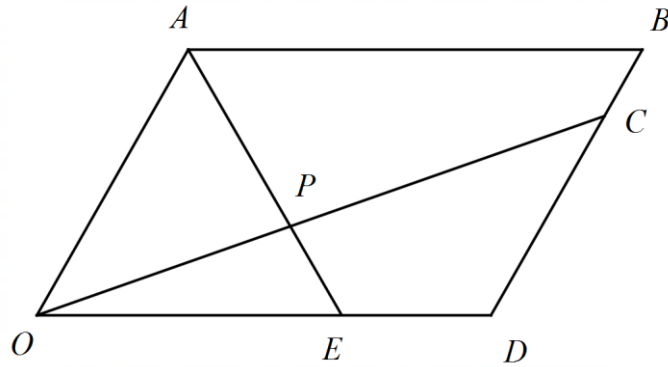
[2]

8. (6 marks)

Parallelogram $OABD$ has C on \overline{DB} such that $\overline{DC} = \frac{3}{5}\overline{DB}$ and E on \overline{OD} such that $\overline{OE} = \frac{2}{3}\overline{OD}$.

Let $\overline{OA} = \underline{a}$, $\overline{OD} = \underline{d}$, $\overline{OP} = h\overline{OC}$ and $\overline{AP} = k\overline{AE}$ where P is the point of intersection of \overline{AE} and \overline{OC} .

Determine the values of h and k .



9. (6 marks)

Paul's aircraft can fly at 250 km/h in still air. It is to be flown from Suva in Fiji to his island getaway Presser Island, 300 km from Suva on a bearing 310° . There is a wind of 40 km/h blowing from 020° . Determine

(a) the course Paul must set to fly directly to Presser Island [4]

(b) the time taken for the flight (to the nearest minute). [2]