TRINITY COLLEGE

Mathematics Specialist Units 1,2
Test 2 2018

Section 1 Calculator Free

Vectors

STUDENT'S NAME _____

DATE: Thursday 29 March **TIME:** 20 minutes **MARKS**: 23

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.

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1. (6 marks)

(a) A vector has a magnitude of 8 and a direction of $030°$. Express the vector in component form. [3]

(b) Point R has a position vector of $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$. Vector $\overrightarrow{RT} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$. Determine the position vector of point T. [3]

2. (8 marks)

Given $\underset{\sim}{a} = 5i - 12j$ and $\underset{\sim}{b} = i + 3j$, determine:

(a) $|\underset{\sim}{a} - \underset{\sim}{b}|$ [2]

(b) $\hat{\underset{\sim}{b}}$ [2]

(c) a vector in the direction of $\underset{\sim}{a} + \underset{\sim}{b}$ with the magnitude of $2\underset{\sim}{b}$ [4]

3. (9 marks)

(a) Given $\underset{\sim}{a} = 3i - 2j$, $\underset{\sim}{b} = 5i + 2j$ and $\underset{\sim}{c} = 2i + tj$, determine

(i) the value of t if $\underset{\sim}{c}$ is parallel to $3\underset{\sim}{a} - \underset{\sim}{b}$ [2]

(ii) the value of t if $-\underset{\sim}{a} + 3\underset{\sim}{b}$ is perpendicular to $\underset{\sim}{c}$ [2]

(b) Given $\underset{\sim}{m} = xi + yj$, $|\underset{\sim}{m}| = \sqrt{113}$, $\underset{\sim}{n} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and $\underset{\sim}{m} \bullet \underset{\sim}{n} = 10$, determine x and y if $y > 0$. [5]

TRINITY COLLEGE

Mathematics Specialist Units 1,2
Test 2 2018

Section 2 Calculator Assumed

Vectors

STUDENT'S NAME _____

DATE: Thursday 29 March **TIME:** 30 minutes **MARKS**: 32

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.

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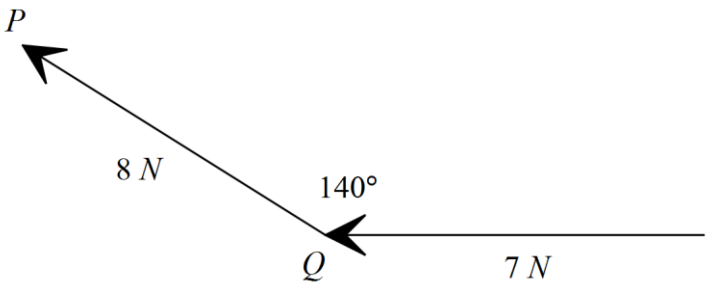
4. (7 marks)

(a) Determine $\underset{\sim}{p} \bullet \underset{\sim}{q}$ for the diagram shown. [2]



(b) For the vectors $\underset{\sim}{c} = 8i - 15j$ and $\underset{\sim}{d} = 3i + 6j$ determine

(i) The scalar projection of $\underset{\sim}{d}$ on $\underset{\sim}{c}$ [2]

(ii) The vector projection of $\underset{\sim}{c}$ on $\underset{\sim}{d}$ [3]

5. (8 marks)

A water bomber is to fly from Perth (P) to a bushfire near Northam (N). A wind is blowing with a velocity of $12i + 15j$ km/hr and $\overrightarrow{PN} = -15i + 65j$ km.

If the water bomber can maintain a still air speed of 270 km/hr, determine:

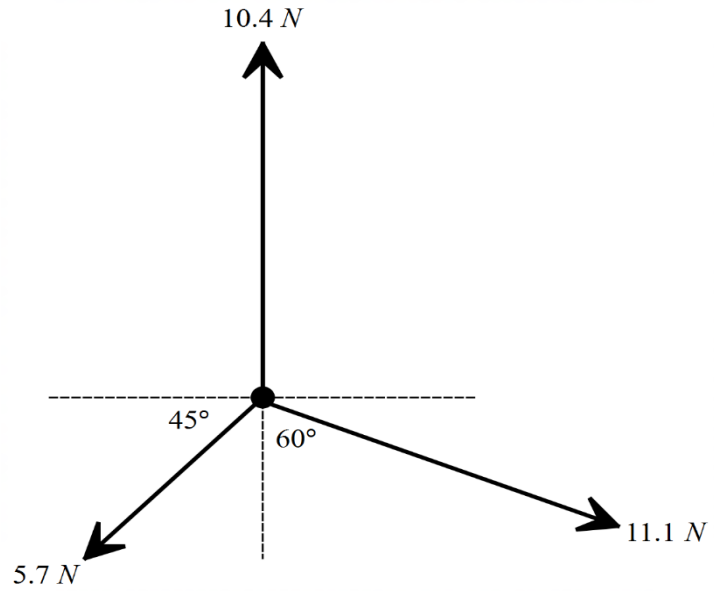
(a) the vector set on the plane to fly directly to the fire [5]

(b) the actual speed of the plane [2]

(c) the time the plane takes to reach the bush fire [1]

6. (9 marks)

Three forces act on a body as shown in the diagram below.



(a) Determine the resultant vector in the form $ai + bj$. [4]

(b) Give the magnitude and true bearing of the resultant in (a). [3]

(c) If another force Q N acted on this system allowing it to be in equilibrium, what would be its magnitude and true bearing? [2]

7. (8 marks)

(a) Given vectors $A\begin{pmatrix}-3\\1\end{pmatrix}$, $B\begin{pmatrix}2\\-6\end{pmatrix}$, $C\begin{pmatrix}9\\-1\end{pmatrix}$ and $D\begin{pmatrix}4\\6\end{pmatrix}$, determine

(i) vector $\overrightarrow{AC}$ and vector $\overrightarrow{BD}$ [2]

(ii) $\overrightarrow{AC} \bullet \overrightarrow{BD}$ [2]

(b) Give a geometric interpretation of (a). [2]

(c) For any 3 vectors, is it possible to determine $\underset{\sim}{a} \bullet \underset{\sim}{b} \bullet \underset{\sim}{c}$? Explain your answer. [2]