TRINITY COLLEGE

Mathematics Specialist Units 1,2
Test 2   2017

Section 1   Calculator Free
Vectors

STUDENT'S NAME _____

DATE: Friday 31 March   **TIME:** 28 minutes   **MARKS**: 28
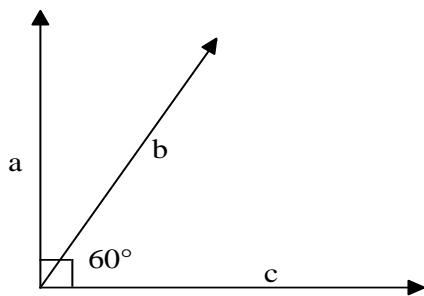
INSTRUCTIONS:

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.   (4 marks)

Given the 3 vectors shown above and $|a| = 5$, $|b| = 6$ and $|c| = 4$, determine

(a)   a • a   [1]

(b)   a • b   [2]

(c)   a • c   [1]

2.   (4 marks)

Determine all vectors of magnitude 5 that are perpendicular to 6i + 8j.

3. (3 marks)

Determine the value/s of m if the vectors $a = \begin{pmatrix} m+1 \\ -2 \end{pmatrix}$ and $b = \begin{pmatrix} m \\ m+1 \end{pmatrix}$ are perpendicular.

4. (3 marks)

A and B have position vectors $\begin{pmatrix} 3 \\ -7 \end{pmatrix}$ and $\begin{pmatrix} 8 \\ 8 \end{pmatrix}$ respectively. Determine the position vector of the point P that divides AB in the ration 3:2.

5.   (10 marks)

Given the vectors $p = 16i - 2j$, $q = 15i + 8j$ and $r = 4i + bj$, determine the value of b in the following situations.

(a) p and r are parallel   [2]

(b) p, q and r are collinear   [4]

(c) r is a unit vector   [1]

(d) $|r| = 7$ [3]

6.   (4 marks)

The position vector of A is $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$. The vector of B relative to A and of B relative to C are $\begin{pmatrix} -8 \\ 2 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ 10 \end{pmatrix}$ respectively. Determine the position vector of C.

TRINITY ⚜ COLLEGE

Mathematics Specialist Units 1,2
Test 2   2017
Section 2   Calculator Assumed
Vectors

STUDENT'S NAME   _____

DATE: Friday 31 March   **TIME:** 32 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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7.   (3 marks)

A coastguard boat is chasing a drug runner's boat and is directly behind it. The drug runner's boat is travelling with constant velocity of (16i – 12j) m/s. The coastguard is gaining on the drug runners at a constant 8 m/s.

Determine the velocity of the coastguard boat.

8.   (5 marks)

To a motorcyclist travelling at 108 km/hr on a bearing of 137°, the wind appears to be coming from a bearing of 191° at 64 km/hr. Determine the true velocity of the wind.

9.   (4 marks)

An object moves with a constant velocity of (-2i - j) m/s. If the initial position of the object, with respect to the origin, is (18i - j) m, determine when the object is 28 m from the origin.

10.   (5 marks)

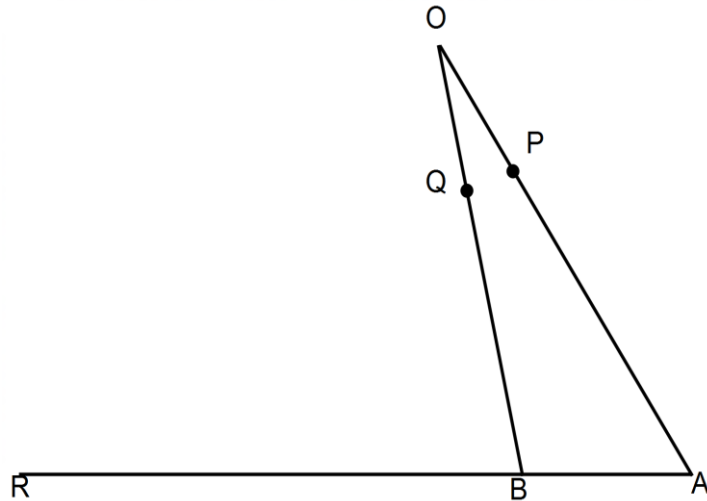Determine the magnitude and the direction of the resultant of the three forces shown in the diagram below.
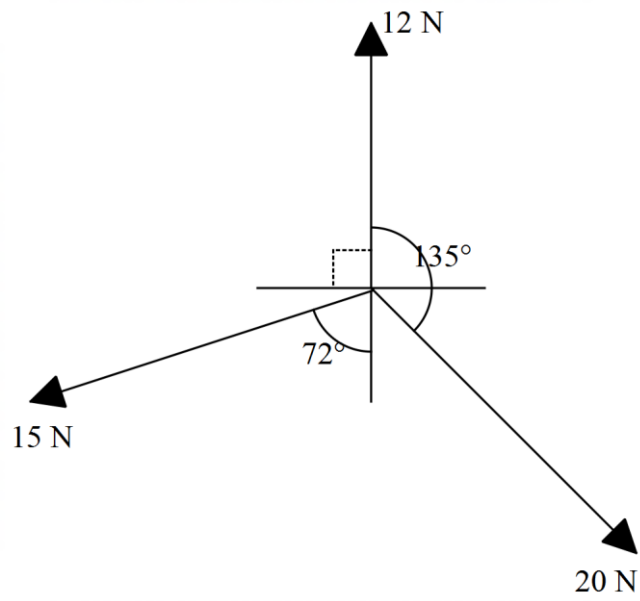
11.   (7 marks)

The origin O and the points P, Q, A, B and R are shown in the diagram below.
Also $\overrightarrow{OP} = \frac{1}{3}\overrightarrow{OA}$, $\overrightarrow{AR} = 3\overrightarrow{AB}$,   and $\left|\overrightarrow{OQ}\right| : \left|\overrightarrow{QB}\right| = 3:4$.

Let $\overrightarrow{OA} = \tilde{a}$ and $\overrightarrow{OB} = \tilde{b}$.

(a)   Determine $\overrightarrow{PQ}$ in terms of $\tilde{a}$ and $\tilde{b}$.   [2]

(b)   Determine $\overrightarrow{PR}$ in terms of $\tilde{a}$ and $\tilde{b}$.   [2]

(c)   Show P, Q and R are collinear.   [3]

12.   (8 marks)

A pilot's destination is Perth from Bali (which is due South of Bali). The jet being flown can travel at 900 km/hr in still air. However, a 60 km/hr wind is blowing from a bearing of 40^0.

(a)   Determine the direction in which the pilot points the jet so that he can fly directly to Perth.   [4]

(b) How long will it take the pilot to fly to Perth given that it is 3100 km from Bali?   [2]

(c)   At what actual speed does the jet fly?   [2]