Tick your teacher
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PERTH MODERN SCHOOL

YR11 MATHEMATICS SPECIALIST – 2018

TEST 3 – Vectors

PERTH MODERN SCHOOL
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NAME: _____ DATE: 14/05/2108 Mark:_____

Calculator Assumed ***Time: 40 minutes*** ***Mark: 35 marks***

Question 1 **(4 marks)**

If $a=-2i+5j$ and $b=xi-2j$ are two vectors. Find:

(a) x if a and b are parallel. (2 marks)

(b) x if a and b are perpendicular. (2 marks)

Question 2 **(3 marks)**

Consider the points $A(-1,6), B(-3,-2)$ and $C(7,3)$. Calculate the angle between BA and BC.

Question 3 **(4 marks)**

(a) Find the scalar projection in the direction of 43^o of a vector of magnitude 20 in the direction of 163^o. (2 marks)

(b) Let $a = i - j$, $b = i + 3j$. Find the vector projection of b in the direction of a. (2 marks)

Question 4 **(5 marks)**

A triangle is formed by three non-zero vectors a, b and c, so that $c = a - b$, and θ is the angle between a and b.

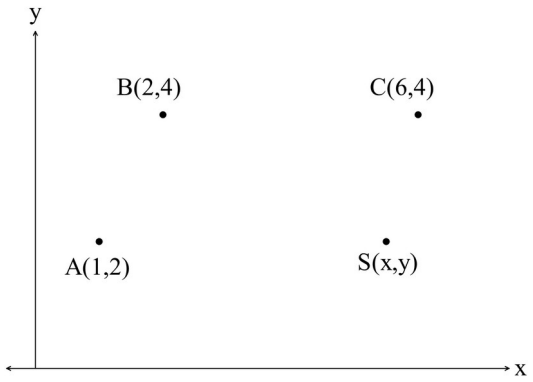
(a) Sketch the triangle. (1 mark)

(b) Explain why $c \cdot c = |c|^2$. (1 mark)

(c) Use $c \cdot c = (a - b) \cdot (a - b)$ to deduce the cosine rule. (3 marks)

Question 5 **(8 marks)**

Consider the quadrilateral in the diagram below.



Use a vector method to

(a) find x and y if $ABCD$ is a parallelogram. (2 marks)

(b) determine the condition(s) required in terms of x and/or y so that $ABCD$ is a trapezium. (4 marks)

(c) show that points A, B and the origin are collinear. (2 marks)

Question 6 **(11 marks)**

A small boat that can maintain a steady speed of 5 ms^{-1} is to cross a river from A to B, where $\overrightarrow{AB}=(35i-105\,j)$ m. A current of $(-i-2\,j)\,ms^{-1}$ flows in the river. The velocity vector that the pilot of the small boat must set to travel from A to B is $a\,i+b\,j$, where a and b are constants.

(a) Explain why $t(a-1)=35$ and $t(b-2)=-105$, where t is a constant. (3 marks)

(b) Eliminate t from the equations in (a) and hence express b in terms of a, simplifying your expression. (3 marks)

(c) Explain why $a^2+b^2=25$. (1 mark)

(d) Use your equations from (b) and (c) to determine the values of a and b. (3 marks)

(e) Determine the time that the small boat will take to travel from A to B. (1 mark)