NAME: _____

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KNOW / 12	APP / 12	INQ / 12	COMM / 6

MCV4U1 - UNIT 7 – APPLICATIONS OF VECTORS

TEST

ROUND ALL FINAL ANSWERS TO THE NEAREST TENTH, UNLESS OTHERWISE STATED.

1) State whether the following expressions are vectors, scalars or meaningless (operations in brackets are completed first). (*K – 4 marks*)

a) $(\vec{a} \times \vec{b}) + (\vec{b} \times \vec{c})$ _____

b) $\vec{a} \bullet \left(\vec{b} - \vec{c}\right)$ _____

c) $\vec{a} + (\vec{b} \bullet \vec{c})$ _____

d) $(\vec{a} \times \vec{b}) \times (\vec{a} \bullet \vec{b})$ _____

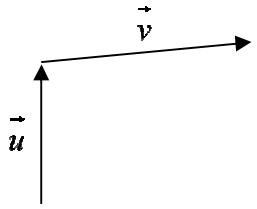
2) For the vectors $\vec{a}$ = (3, -2, 1) and $\vec{b}$ = (-4, 5, 3), determine each of the following.

a) $-2\vec{a} \bullet \left(3\vec{b} - \vec{a}\right)$ (*K - 1 mark*)

b) $\vec{a} \times \vec{b}$ (*K - 1 mark*)

c) $\vec{a} \downarrow \vec{b}$ (*K - 1 mark*)

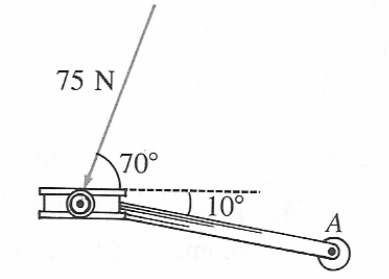
3) For the diagram on the right, indicate whether $\vec{u} \times \vec{v}$ acts into or out of the page. (*K – 1 mark*)



4) Determine the angle, to the nearest tenth of a degree, between the vectors (4, 1, 2) and (3, -2, 5). (*K – 2 marks*)

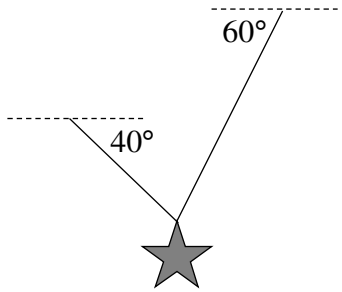
5) Determine the direction angles for the vector (2, -7, 3). (*K – 2 marks*)

6) A bicycle pedal is pushed by a 75 N force exerted by the foot of its rider, as shown in the following diagram. If the shaft of the pedal is 0.15 m long, find the magnitude of the torque about *A*. (*A – 3 marks*)



7) Determine if the vectors (1, 2, 3), (2, -1, 3) and (8, 1, 15) are coplanar. (*A – 2 marks*)

8) An ornamental star that weighs 196 N is suspended by two chains fastened to horizontal beams at different heights, as shown in the diagram below. Determine the tension in each chain. (*A - 4 marks*)



9) a) A kayaker can paddle at a speed of 6 km/h in still water. If she wants to go straight across a river, and the current moves at 3 km/h, at what angle with the shore must she head in order to travel straight across the river. (*A - 3 marks*)

10) Determine all **unit** vectors that are parallel to the *xy*-plane and perpendicular to the vector (1, -2, 2). Present your answer in exact form (you do not need to rationalize denominators). (*I – 5 marks*)

11) If $|\vec{a}| = 4$, $|\vec{b}| = 7$ and $|\vec{a} \downarrow \vec{b}| = \sqrt{3}$, determine the exact value of $\vec{a} \bullet \vec{b}$.
(*I – 3 marks*)

12) Triangle *ABC* has vertices *A*(2, 1, 3), *B*(4, 1, 5) and *C*(3, 2, 6). Find the area of the triangle.
(*I – 4 marks*)

13) If $\vec{a} \bullet \vec{b} = \vec{a} \bullet \vec{c}$, is it always true that $\vec{b} = \vec{c}$? Explain. (*C – 3 marks*)

14) Prove that the dot product is distributive over addition in 3-space. That is, prove that $\vec{u} \bullet (\vec{v} + \vec{w}) = \vec{u} \bullet \vec{v} + \vec{u} \bullet \vec{w}$ in $\Re^3$. (*C – 3 marks*)