Knowledge	Thinking	Application	Communication
/8	/8	/8	/8

Total /32

MCV4U Test

Name:

Date:

Instructions: *Make sure to simplify answers as much as possible. Give exact answers where possible. If you give an approximate answer, round to 2 decimal places.*

1) Given the vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$, construct the following: [3]

a) $\vec{a} + \vec{c}$
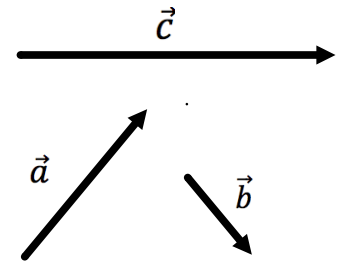
b) $\vec{c} - \vec{b}$

c) $2\vec{a} - \vec{b} + \vec{c}$

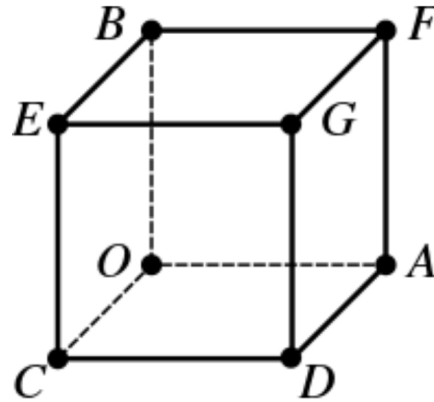**2)** Write each of the following as a SINGLE vector. [4]

a) $\overrightarrow{OB} + \overrightarrow{BF}$

b) $\overrightarrow{CE} - \overrightarrow{CD}$

c) $\overrightarrow{EB} + \overrightarrow{DC}$

d) $\overrightarrow{GF} - \overrightarrow{OA}$

e) $\overrightarrow{FB} + \overrightarrow{BD} - \overrightarrow{OC}$

3) Given that $\overrightarrow{EC} = \vec{u}$, $\overrightarrow{CD} = \vec{v}$, $\overrightarrow{AB} = 2\overrightarrow{EC}$, and $\overrightarrow{BC} = 3\overrightarrow{CD}$. Write each of the following vectors in terms of $\vec{u}$ and $\vec{w}$. [4]
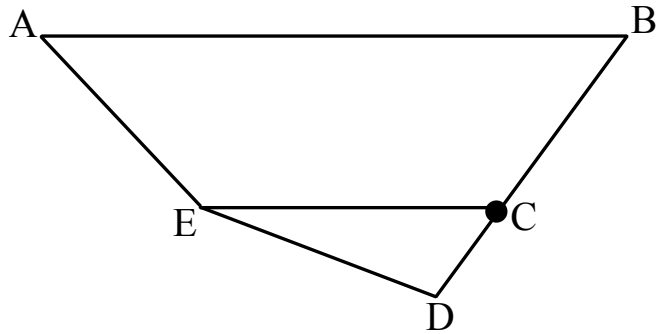
a) $\overrightarrow{ED}$

b) $\overrightarrow{BE}$

c) $\overrightarrow{AE}$

d) $\overrightarrow{DA}$

4) The vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 10$ and $|\vec{b}| = 6$, and the angle between them is $40°$.

a) What is the direction of $\vec{a} - \vec{b}$ relative to $\vec{b}$? Include a diagram. [3]

b) Determine a unit vector in the direction of $\vec{a} + \vec{b}$. Include a diagram. Give an approximate answer rounded to 2 decimal places. [3]

5) Create an expression for the magnitude of the horizontal and vertical components of a force of 10 N exerted at an angle of $15°$ to the horizontal. Include a diagram in your answer.[3]

Answer 3 of the following 4 questions. Include a diagram and show your work. [12]

6) An airplane that heads out in a direction of $S20°E$ has an air velocity of 450 km/h. Measurements from the ground indicate that the airplane has a direction of $S37.5°E$ with a ground velocity of 398 km/h. What is the velocity of the wind (magnitude and direction)?

7) A 100-N box is held by two cables fastened to the ceiling. The cables make angles of 25° and 40° with the ceiling. Determine the tension in each cable.

8) A box with a mass of 10 kg rests on a frictionless ramp inclined at an angle of 35°. Calculate the magnitude of a normal force and a force applied at an angle of 20° to the ramp that would keep the box at rest.

9) John wants to canoe across to the other side of a 40 meter wide river. The river is flowing at a rate of 10 m/min and John can paddle at 25 m/min. In what direction should he aim the canoe in order to land at a point directly opposite of his starting point? How long will it take to make this crossing?