MCV4U Unit Test #2 3-space /32 + /4 = /35 Name: _____

Useful formulae: $|\vec{u} \times \vec{v}| = |\vec{u}||\vec{v}|\sin\theta$ $\vec{u} \cdot \vec{v} = |\vec{u}||\vec{v}|\cos\theta$ $\tau = \vec{r} \times \vec{F}$ $|\tau| = |\vec{r}||\vec{F}|\sin\theta$

1. demonstrate an understanding of vectors in two-space and three-space by representing them algebraically and geometrically and by recognizing their applications;

2. perform operations on vectors in two-space and three-space, and use the properties of these operations to solve problems, including those arising from real-world applications;

1. a) Locate the points A(3, -1, 2), B(-2, -1, 3) and C(0, -1 -3) on the x, y and z axes below.

   b) What is the equation of the plane containing the points A, B and C?

   _____

[3]

[1]

2. Given the points A (-2, 3, -7) and B (4, 8, -5), determine the vector $\vec{AB}$ and its magnitude.

[2]

3. Determine the value of a and b such that the vector pair are collinear
$\vec{r}$ [-9, a, 15] and $\vec{s}$ [b, 2, -5]

[2]

4. Determine the value of k so that $\vec{u}$ [-5, k, 3] and $\vec{v}$ [1, 2, -7] are orthogonal.

[3]

5. a) Use the cross product to determine the angle between $\vec{u}$ [5, -4, 1] and $\vec{v}$ [-3, 2 7].
[3]

b) Use the dot product to verify your answer in part a).

[3]

6. A force of 75 N is applied to a wrench in a counterclockwise direction at $60°$ to the handle, 12 cm from the center of the bolt.

a) Calculate the magnitude of the torque.

b) In what direction does the bolt move?

[3]

7. Given $\vec{u} = [\ 3, -1, 4\ ]$ $\vec{v} = [\ -5, 2, -1\ ]$ and $\vec{w} = [\ 8, 1, -2\ ]$, evaluate $\vec{u} \cdot (\vec{v} \times \vec{w}) + |\vec{v}|$

[4]

8. If $\vec{p}$ = [1, 2, -3] and $\vec{q}$ = [2, -1, 4], find a unit vector perpendicular to both $\vec{p}$ and $\vec{q}$.

[3]

9 a) Show that vector $\vec{a}$ = [1, 12, -29] can be written as a linear combination of $\vec{b}$ = [1, 2, -3] and $\vec{c}$ = [3, 1, 4].

[4]

b) What does it mean if you can write two vectors as a linear combination of another?

[1]