First Name:_____     Last Name: _____     Student ID: _____

### *An introduction to vectors*

**1.** Given the magnitude of two vectors $|\vec{a}| = 4$ and $|\vec{b}| = 7$, and the angle between them when placed tail to tail as being $\theta = 60°$, find the magnitude of the vector sum $\vec{s} = \vec{a} + \vec{b}$ and the direction (the angles between the vector sum and each vector). Draw a diagram.

**2.** Given the magnitude of two vectors $|\vec{a}| = 10$ and $|\vec{b}| = 14$, and the angle between them when placed tail to tail as being $\theta = 120°$, find the magnitude of the vector difference $\vec{d} = \vec{a} - \vec{b}$ and the direction (the angles between the vector difference and each vector). Draw a diagram.
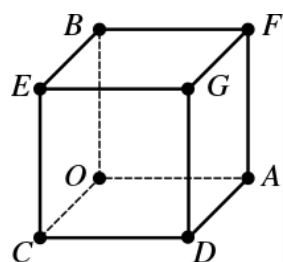
**3.** Given $|\vec{a}| = 10$, $|\vec{b}| = 15$, and $|\vec{a} + \vec{b}| = 20$, find $|\vec{a} - \vec{b}|$.

**4.** If point *P* is the midpoint of the segment *AB* , then for any point *O*, we have

$$\overrightarrow{OP} = \frac{1}{2}(\overrightarrow{OA} + \overrightarrow{OB})$$

**5.** In $\triangle ABC$, *AM*, *BN*, and *CP* are medians. Prove that $\overrightarrow{AM} + \overrightarrow{BN} + \overrightarrow{CP} = \vec{0}$.

**6.** The drawing below shows a unit cube. Let $\hat{\imath}=\overrightarrow{OA}$, $\hat{\jmath}=\overrightarrow{OB}$, $\hat{k}=\overrightarrow{OC}$.
Write each of the following vectors in terms of $\hat{\imath}$, $\hat{\jmath}$, and $\hat{k}$.



a.  $\overrightarrow{OF}$                    b. $\overrightarrow{ED}$                    c. $\overrightarrow{AG}$

**7.** Find the magnitude of the sum $\vec{a} + \vec{b}$ and the difference $\vec{a} - \vec{b}$ between the vectors $\vec{a} = \vec{\imath} - \vec{\jmath}$ and $\vec{b} = (1,2,-1)$.

**8.** Prove that the vectors $\vec{a} = (2,4,-6)$ r and $\vec{b} = (-1,-2,3)$ are parallel.

**9.** Prove that the points A(2,−1,0) , B(−1,0,2) , and C(0,1,2) are not collinear.

**10.** For points $R(-1, 2, -4\sqrt{5})$ and Q(-1, -2, 0) given, find

 a. The position vector and the magnitude of the position vector $\overrightarrow{OR}$

 b. The displacement vector $\overrightarrow{RQ}$ and its magnitude.

**11.** Find a unit vector parallel to each of the given vectors.

a.  $\vec{v} = (2,-5)$                                   b. $\overrightarrow{OZ} = \hat{\imath} - 2\hat{\jmath} + 4\hat{k}$