

**W1 – Cartesian Vectors**

MCV4U

Jensen

Unit 5

1) Express each vector in terms of the unit vectors  $\hat{i}$  and  $\hat{j}$ .

a)  $[-2, 0]$

b)  $[0, 3]$

c)  $[3, 2]$

d)  $[-1, 6]$

2) Express each vector as a position vector  $[a, b]$ .

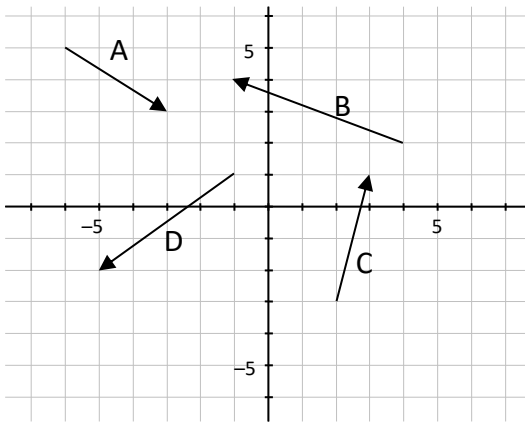
a)  $3\hat{i} + 2\hat{j}$

b)  $4\hat{j}$

c)  $-7\hat{i} + 3\hat{j}$

d)  $-9\hat{i}$

3) Write the coordinates of each Cartesian vector and determine the magnitude.



4) Given the vector  $\vec{v} = [2, -5]$ .

a) State the vertical and horizontal vector components of  $\vec{v}$ .

b) Find two vectors that are collinear with  $\vec{v}$ .

5) If  $\vec{u} = [-3, 5]$  and  $\vec{v} = [2, 9]$ .

a)  $\vec{u} + \vec{v}$

b)  $\hat{u}$

c)  $-3\vec{u} + 4\vec{v}$

d)  $7\vec{u} + 6\hat{i} - 8\hat{j} - 3\vec{v}$

e)  $|\vec{v}|$

f)  $|-3\vec{u} - 2\vec{v}|$

6. Write each force as a Cartesian vector.

a) 750 N applied  $45^\circ$  to the horizontal

b) 215 N applied  $68^\circ$  to the vertical

c) 450 N applied upwards

d) 17 N applied downwards

e) 1000 N east

f) 80 N west

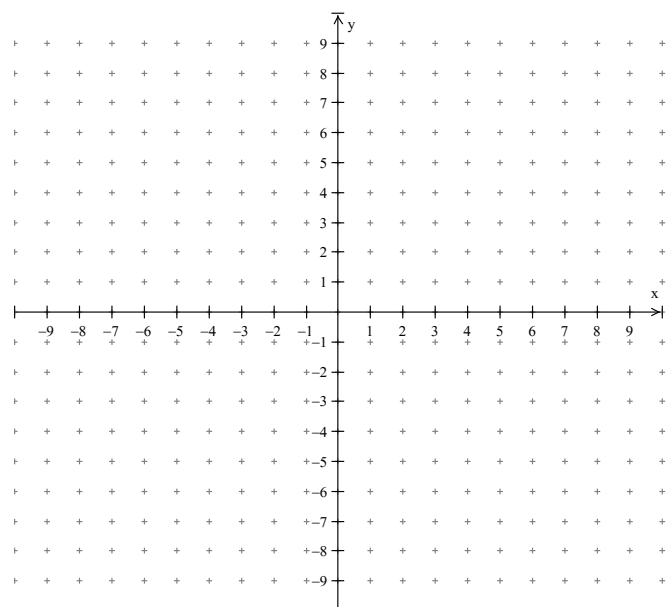
7) An aircraft is travelling at 750 km per hour at an angle of  $35^\circ$  to the level ground below. Find the force in component form as a Cartesian vector.

8) A mom is pulling a sled exerting a force of 220 N along a rope that makes an angle of  $20^\circ$  to the horizontal. Write this force in component form as a Cartesian vector.

9) Let  $\vec{a} = [-2, 5]$  and  $\vec{b} = [5, -7]$ .

a) Plot the two vectors.

b) Which is greater:  $|\vec{a} + \vec{b}|$  or  $|\vec{a}| + |\vec{b}|$  ?



10) Given the points  $P(-6,1)$ ,  $Q(-2,-1)$ , and  $R(-3,4)$ , find...

a)  $\overrightarrow{QP}$

b)  $|\overrightarrow{RP}|$

c) perimeter of  $\Delta PQR$

11) Which vector is NOT colinear with  $\vec{a} = [6, -4]$ ?

$\vec{b} = [3, -2]$ ,  $\vec{c} = [-6, -4]$ ,  $\vec{d} = [-6, 4]$ , or  $\vec{e} = [-9, 6]$

**ANSWER KEY:**

1) a)  $-2\hat{i}$  b)  $3\hat{j}$  c)  $3\hat{i} + 2\hat{j}$  d)  $-\hat{i} + 6\hat{j}$

2) a)  $[3, 2]$  b)  $[0, 4]$  c)  $[-7, 3]$  d)  $[-9, 0]$

3) a)  $[3, -2]$ ;  $\sqrt{13}$  b)  $[-5, 2]$ ;  $\sqrt{29}$  c)  $[1, 4]$ ;  $\sqrt{17}$  d)  $[-4, -3]$ ; 5

4) a) vertical: 2; horizontal: -5 b) e.g.,  $[4, -10]$ ,  $[-6, 15]$

5. a)  $[-1, 14]$  b)  $\left[-\frac{3}{\sqrt{34}}, \frac{5}{\sqrt{34}}\right]$  c)  $[17, 21]$  d)  $[-21, 0]$  e)  $\sqrt{85}$  f)  $\sqrt{1114}$

6) a)  $[750 \cos 45, 750 \sin 45]$  b)  $[215 \cos 22, 215 \sin 22]$  c)  $[0, 450]$  d)  $[0, -17]$  e)  $[1000, 0]$  f)  $[-80, 0]$

7)  $[750 \cos 35, 750 \sin 35] \cong [614.36, 430.18]$

8)  $[220 \cos 20, 220 \sin 20] \cong [206.7, 75.2]$

9) a)  b)  $|\vec{a}| + |\vec{b}|$  is greater

10) a)  $[-4, 2]$  b)  $3\sqrt{2}$  units c) 13.8 units

11)  $\vec{c}$