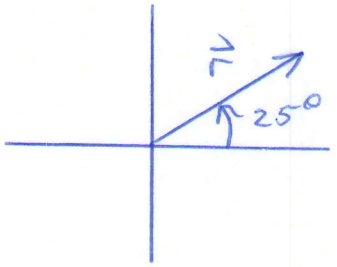
Quiz 2

Name: _____ Student Number: _____

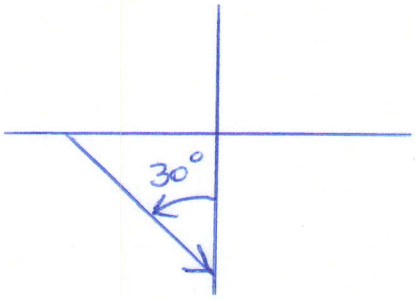
1. (2 marks) Express the vector $\vec{r}$ in the form $\vec{r} = (x, y)$. In each case the vector has a length of 2 units.

a)



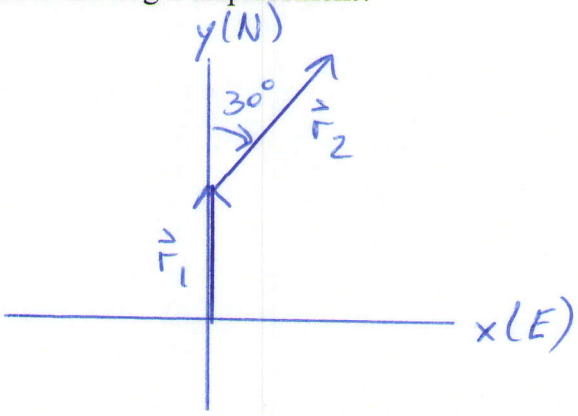
$\vec{r} = 2(\cos 25°, \sin 25°)$

b)



$\vec{r} = 2(\sin 30°, -\cos 30°)$

2. (4 marks) A dog walks north 2 km. She then turns 30° towards the east and runs 3 km. What is the dog's displacement?



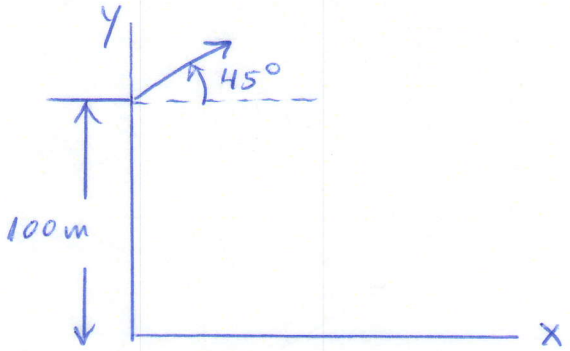
Displacement $\vec{r} = \vec{r}_1 + \vec{r}_2$

$= (0, 2) + 3(\sin 30°, \cos 30°)$

$= (1.5, 4.6)$

3. A bullet is fired from a cliff of height 100 meter at a 45° angle with respect to the horizontal. The initial speed of the bullet is 250 m/sec.

a) (2 marks) How long does it take for the bullet to hit the ground?



$$y(t) = y_0 + u_y t + \frac{a_y}{2} t^2$$

$$0 = 100 + 250 \sin 45^\circ t - \frac{10}{2} t^2$$

$$= t^2 - 35.4t - 20$$

$$t = \frac{35.4 \pm \sqrt{35.4^2 + 80}}{2}$$

$\therefore$ bullet hits ground at $t = 36$ sec.

b) (2 marks) Where does the bullet hit the ground?

$$x = u_x t$$

$$x(36) = 250 \cos 45^\circ \times 36$$

$$= 6364 \text{ meters.}$$

Total = 10 marks