b. Parpendicular to
$(2, -2, 3)$

$\vec{a} \cdot \vec{b} = \cdot \cos 90$

but $\cos 90 = 0$

So $\vec{a} \cdot \vec{b} = 0$

$(3, -3, 3) \cdot (a_1, a_2, a_3) = 0$

$a_2 = 1$

$a_3 = 2$

Then

$2a_1 - 2(-1) + 3(2) = 0$

$2a_1 + 2 + 6 = 0$

$2a_1 = -8$

$a_1 = -4$

$= (-4, -1, 2)$

$$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|a|\cdot|b|}$$

$$= \frac{20}{\sqrt{77}\cdot\sqrt{14}}$$

$$= \frac{20}{32.83}$$

$$\cos\theta = 0.6091$$

$$52.48^\circ$$

Question 3

A (1, 5, -2)

B (0, 2, -4)

(a) The vector $\overrightarrow{BA}$

(1-0)

(1-0, 5-2, -2+4)

= (1, 3, 2)

(b) $|\overrightarrow{BA}|$ or $|\overrightarrow{AB}|$

$\sqrt{1^2+3^2+2^2}$

$= 1+9+4$

$= \sqrt{14}$

Question 4

a (parallel to (b)

(2, -2, 3)

two vectors are parallel iff

$u_1, u_2, u_3 = c(u_1, u_2, u_3)$ where c is a constant

So $(2, -2, 3) = 2(2, -2, 3)$

$= (4, -4, 6)$

For parallel

(2, 12) (6, k)

$\vec{v}$ $\begin{pmatrix} 2 \\ -12 \end{pmatrix}$ $\begin{pmatrix} 6 \\ k \end{pmatrix}$

$2n \in 6$

$n = 3$

$-12n = k$

$-12(3) = -36$

$k = -36$.

Question 2

$\vec{u} = (3, 8, 2)$ $\vec{v} = (-2, 3, 1)$

(a) $\vec{u} \cdot \vec{v}$

$u_x \times v_x + u_y \times v_y + u_z \times v_z$

$(3 \times -2) + (8 \times 3) + (2 \times 1)$

$-6 + 24 + 2$

$= 20$

(b) $\vec{u} \times \vec{v}$

$c_x = u_y v_z - u_z v_y = (8 \times 1) - (2 \times 3) = 2$

$c_y = u_z v_x - u_x v_z = (2 \times -2) - (3 \times 1) = -7$

$c_z = u_x v_y - u_y v_x = (3 \times 3) - (8 \times -2) = 25$

$\vec{a} \times \vec{b} = (2, -7, 25)$

(c)

$|\vec{u}| = \sqrt{(2^2 + 8^2 + 3^2)} = \sqrt{(4 + 64 + 9)} = \sqrt{77}$

$|\vec{v}| = \sqrt{((-2)^2 + 3^2 + 1^2)} = \sqrt{4 + 9 + 1} = \sqrt{14}$

Question 9

$\vec{a} = 2, -2, 4 \quad \vec{b}\ (0, 2, 3)$

$\vec{a} \cdot \vec{b}$

$a \cdot b = a_x \times b_x + a_y \times b_y + a_z + b_z$

$= (2 \times 0) + (-2 \times 2) + (4 \times -3)$

$0 + -4 + -12$

$= -16.$

$\vec{a} \times \vec{b}$

a b

$(2, -2, 4) \quad (0, 2, -3)$

$c_x = a_y b_z - a_z b_y = (-2 \times -3) - (4 \times 2) = -2$

$c_y = a_z b_x - a_x b_z = (4 \times 0) - (2 \times 3) = -6$

$c_z = a_x b_y - a_y b_x = (2 \times 2) - (-2 \times 0) = 4$

$a \times b = (-2, -6, 4)$

Question 1

$u\ (2i - 12k) \quad v\ (6i + k)$

Angle u is perpendicular to v

$\vec{u} \cdot \vec{v} = 0$

$(2, -12) \cdot (6, k) = 0$

$12 - 12k = 0$

$-12k = 12$

$k = 1$