

## Subject:

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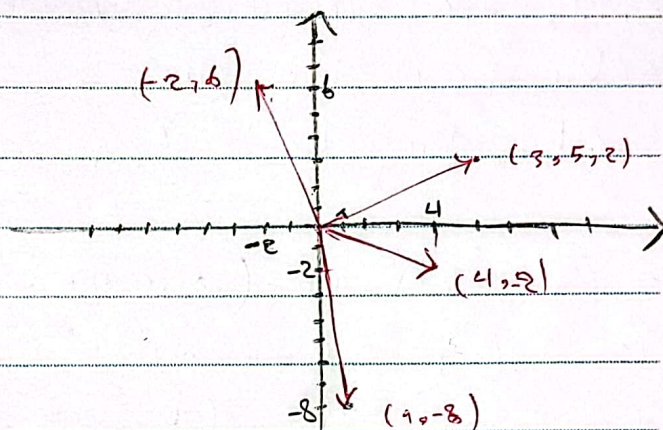
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$$a) (1, 2) + (3, -4) = (1+3, 2+(-4)) = (4, -2) \quad (1)$$

$$b) (1, 2) - (3, -4) = (1-3, 2-(-4)) = (-2, 6)$$

$$c) 2(1, 2) + \frac{1}{2}(3, -4) = (2, 4) + (1.5, -2) = (2+1.5, 4+(-2)) \\ = (3.5, 2)$$

$$d) -2(1, 2) + (3, 4) = (-2, -4) + (3, 4) = (-2+3, -4+4) = (1, 0)$$



$$a) u + v = (u_x + u_y + u_z) + (v_x + v_y + v_z) \quad (3)$$

$$= (u_x + v_x, u_y + v_y, u_z + v_z) = (v_x + u_x, v_y + u_y, v_z + u_z)$$

$$= (v_x, v_y, v_z) + (u_x, u_y, u_z) = v + u$$

$$b) u + (v + w) = (u_x, u_y, u_z) + ((v_x, v_y, v_z) + (w_x, w_y, w_z))$$

$$= (u_x, u_y, u_z) + (v_x + w_x, v_y + w_y, v_z + w_z)$$

$$= (u_x + (v_x + w_x), u_y + (v_y + w_y), u_z + (v_z + w_z))$$

$$= ((u_x + v_x) + w_x, (u_y + v_y) + w_y, (u_z + v_z) + w_z)$$

$$= (u_x + v_x, u_y + v_y, u_z + v_z) + (w_x, w_y, w_z)$$

$$= ((u_x + v_x), u_y + v_y, u_z + v_z) + (w_x, w_y, w_z)$$

$$= (u + v) + w$$

$$c) (ck)u = (ck)(u_x, u_y, u_z) = (ck)u_x, (ck)u_y, (ck)u_z$$

$$= (c(ku_x), c(ku_y), c(ku_z)) = c(ku_x, ku_y, ku_z)$$

$$= c(ku)$$



$$\begin{aligned}
 d) \quad k(u+v) &= k(u_x, u_y, u_z) + (v_x, v_y, v_z) \\
 &= k(u_x + v_x, u_y + v_y, u_z + v_z) = (k(u_x + v_x), k(u_y + v_y), k(u_z + v_z)) \\
 &= (ku_x + kv_x, ku_y + kv_y, ku_z + kv_z) \\
 &= (ku_x, ku_y, ku_z) + (kv_x, kv_y, kv_z) = ku + kv \\
 e) \quad u(k+C) &= (u_x, u_y, u_z)(k+C) \\
 &= (u_x(k+C), u_y(k+C), u_z(k+C)) \\
 &= (ku_x + Cu_x, ku_y + Cu_y, ku_z + Cu_z) \\
 &= (ku_x, ku_y, ku_z) + (Cu_x, Cu_y, Cu_z) = ku + Cu
 \end{aligned}$$

$$\begin{aligned}
 2(1, 2, 3) - \alpha &= (-2, 0, 4) = -2(1, 2, 3) \\
 (2, 4, 6) - 2\alpha &= (2, 0, 4) = (-2, -4, -6) \\
 (2, 4, 6) - 2\alpha &= (-4, -4, -2) \Rightarrow -2\alpha = (-6, -8, -8) \\
 \alpha &= (3, 4, 4)
 \end{aligned}$$

$$\begin{aligned}
 |u| &= \sqrt{(-1)^2 + 3^2 + 2^2} = \sqrt{1+9+4} = \sqrt{14} \\
 \hat{u} &= \frac{u}{|u|} = \left( -\frac{1}{\sqrt{14}}, \frac{3}{\sqrt{14}}, \frac{2}{\sqrt{14}} \right) \\
 |v| &= \sqrt{3^2 + (-4)^2 + 1^2} = \sqrt{9+16+1} = \sqrt{26} \\
 \hat{v} &= \frac{v}{|v|} = \left( \frac{3}{\sqrt{26}}, \frac{-4}{\sqrt{26}}, \frac{1}{\sqrt{26}} \right)
 \end{aligned}$$

$$\begin{aligned}
 a) \quad u \cdot v &= (u_x, u_y, u_z) \cdot (v_x, v_y, v_z) \\
 &= (u_x v_x + u_y v_y + u_z v_z) = (u_x v_x + v_y u_y + v_z u_z) \\
 &= (v_x, v_y, v_z) \cdot (u_x, u_y, u_z) = v \cdot u
 \end{aligned}$$



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$$1) b) u \cdot (v+w) = (u_x, u_y, u_z) \cdot (v_x+w_x, v_y+w_y, v_z+w_z) \quad (9)$$

$$2) = u_x(v_x+w_x) + u_y(v_y+w_y) + u_z(v_z+w_z)$$

$$3) = u_x v_x + u_x w_x + u_y v_y + u_y w_y + u_z v_z + u_z w_z$$

$$4) = u_x v_x + u_y v_y + u_z v_z + u_x w_x + u_y w_y + u_z w_z$$

$$5) = (u_x v_x + u_y v_y + u_z v_z) + (u_x w_x + u_y w_y + u_z w_z)$$

$$6) = u \cdot v + u \cdot w$$

$$7) c) k(u \cdot v) = k(u_x v_x + u_y v_y + u_z v_z)$$

$$8) = (k u_x) v_x + (k u_y) v_y + (k u_z) v_z = (k u) \cdot v$$

$$9) = (u_x (k v_x) + u_y (k v_y) + u_z (k v_z)) = u \cdot (k v)$$

$$10) d) v \cdot v = v_x v_x + v_y v_y + v_z v_z = v_x^2 + v_y^2 + v_z^2$$

$$11) = (\sqrt{v_x^2 + v_y^2 + v_z^2})^2 = |v|^2$$

$$12) e) 0 \cdot v = 0 v_x + 0 v_y + 0 v_z = 0$$

$$13) 17) u \times ku = (u_y k u_z - u_z k u_y, u_z k u_x - u_x k u_z, u_x k u_y - u_y k u_x) \Rightarrow (0, 0, 0) = \textcircled{0}$$