

12.3 1-40 odd

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7:49 PM

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① b, c, d are meaningful

$$\textcircled{3} \quad a = \langle 4, -1 \rangle \quad b = \langle 3, 6 \rangle$$

$$a \cdot b = 12 + (-6) = 6$$

$$\textcircled{5} \quad a = \langle 5, 0, -2 \rangle \quad b = \langle 3, -1, 10 \rangle$$

$$a \cdot b = 15 + 0 - 20 = -5$$

$$\textcircled{7} \quad a = i - 2j + 3k = \langle 1, -2, 3 \rangle \quad b = 5i + 9k = \langle 5, 0, 9 \rangle$$

$$a \cdot b = 5 + 0 + 27 = 32$$

$$\textcircled{9} \quad |a| = 12 \quad |b| = 15 \quad \angle_a^b = \pi/6$$

$$a \cdot b = 12 \cdot 15 \cos \pi/6$$

$$= 180(\sqrt{3}/2)$$

$$= 90\sqrt{3}$$

$$\textcircled{11} \quad u \cdot v = \frac{1}{2} \quad u \cdot w = -\frac{1}{2}$$

$$\textcircled{13} \quad i = \langle 1, 0, 0 \rangle \quad j = \langle 0, 1, 0 \rangle \quad k = \langle 0, 0, 1 \rangle$$

a $i \cdot j = 0, j \cdot k = 0, k \cdot i = 0$ by dot product ruleb $i \cdot i = 1, j \cdot j = 1, k \cdot k = 1$ by dot product rule

$$\textcircled{15} \quad a = \langle 3, 4 \rangle \quad b = \langle 5, 12 \rangle$$

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

$$\cos \theta = \frac{15 + 48}{(\sqrt{9+16})(\sqrt{25+144})} = \frac{63}{65}$$

$$\theta = \cos^{-1} \frac{63}{65} \approx 14.2^\circ$$

$$\textcircled{17} \quad a = \langle 1, 2, 3 \rangle \quad b = \langle 4, 0, -1 \rangle$$

$$\cos \theta = \frac{4+0-3}{(\sqrt{1+4+9})(\sqrt{16+1})} = \frac{1}{\sqrt{238}}$$

$$\theta \approx 86.5^\circ$$

$$(19) \ a = j + k \quad \langle 1, 1, 0 \rangle \quad b = i + 2j - 3k \quad \langle 1, 2, -3 \rangle$$

$$\cos \theta = \frac{1+2+0}{\sqrt{2}\sqrt{1+4+9}} = \frac{3}{\sqrt{28}}$$

$$\theta \approx 79.1^\circ$$

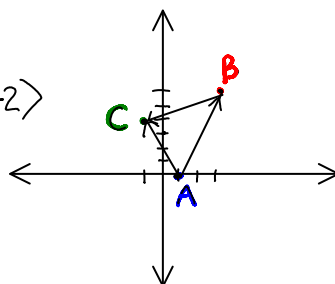
$$(21) \ A(1,0), \ B(3,6), \ C(-1,4)$$

$$\vec{AB} = \langle 2, 6 \rangle \quad \vec{AC} = \langle -2, 4 \rangle \quad \vec{BC} = \langle -4, -2 \rangle$$

$$\angle B \ \vec{AB}, \vec{BC}: \cos \theta = \frac{-8-12}{(\sqrt{4+36})(\sqrt{16+4})}$$

$$\cos \theta = \frac{20}{20\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$\angle B \ \theta = 45^\circ$$



$$\angle A \ \vec{AB}, \vec{AC}: \cos \theta = \frac{-4+24}{(\sqrt{4+36})(\sqrt{4+16})} = \frac{20}{20\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$\angle A \ \theta = 45^\circ$$

$$\angle C \ \vec{AC}, \vec{BC}: \cos \theta = \frac{8-8}{\dots} = 0$$

$$\angle C \ \theta = 90^\circ$$

$$(23) \ a = \langle -5, 3, 7 \rangle \quad b = \langle 6, -8, 2 \rangle$$

$$a \cdot b = -30 - 24 + 14 = 40$$

neither

$$(b) \ a = \langle 4, 6 \rangle \quad b = \langle -3, 2 \rangle$$

$$a \cdot b = -12 + 12 = 0$$

orthogonal

$$(c) \ a = -i + 2j + 5k = \langle -1, 2, 5 \rangle \quad b = 3i + 4j - k = \langle 3, 4, -1 \rangle$$

$$a \cdot b = -3 + 8 - 5 = 0$$

orthogonal

$$(d) a = 2i + 6j - 4k = \langle 2, 6, -4 \rangle \quad b = -3i - 9j + 6k = \langle -3, -9, 6 \rangle$$

$$a \cdot b = -6 - 54 - 24 = -94$$

parallel

$$(25) P(1, -3, -2) \quad Q(2, 0, -4) \quad R(6, -2, -5)$$

$$\vec{PQ} = \langle 1, 3, -2 \rangle \quad \vec{PR} = \langle 5, 1, -3 \rangle \quad \vec{QR} = \langle 4, -2, -1 \rangle$$

$$\vec{PQ} \cdot \vec{PR} = 5 + 3 + 6 = 14$$

not rt. $\angle$

$$\vec{PR} \cdot \vec{QR} = 20 - 2 + 3 = 21$$

not rt. $\angle$

$$\vec{PQ} \cdot \vec{QR} = 4 - 6 + 2 = 0 \quad \text{orthogonal}$$

yes rt. $\angle$

$$(27) i+j \text{ and } i+k$$

$$\frac{(i-j-k)}{\sqrt{3}}$$

$$(29) \langle 3, 4, 5 \rangle \quad \frac{\langle 3, 4, 5 \rangle}{\sqrt{9+16+25}} = \left\langle \frac{3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle \text{ or } 65^\circ, 56^\circ, 45^\circ$$

$$(31) 2i + 3j - 6k = \langle 2, 3, -6 \rangle$$

$$\frac{\langle 2, 3, -6 \rangle}{\sqrt{4+9+36}} = \left\langle \frac{2}{7}, \frac{3}{7}, -\frac{6}{7} \right\rangle = 73^\circ, 65^\circ, 149^\circ$$

$$(33) \langle c, c, c \rangle \quad c > 0$$

$$\frac{c}{\sqrt{3c^2}} = \frac{c}{c\sqrt{3}} = \frac{1}{\sqrt{3}} \quad 55^\circ, 55^\circ, 55^\circ$$

$$(35) a = \langle 3, -4 \rangle \quad b = \langle 5, 0 \rangle$$

$$a \cdot b = 15 - 0 = 15$$

$$|a| = \sqrt{9+16} = \sqrt{25} = 5$$

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$$\text{scalar} = \frac{15}{5} = 3$$

$$\text{vector} = \left(\frac{15}{5}\right)\left(\frac{\langle 3, -4 \rangle}{5}\right)$$

$$= \left(\frac{3}{5}\right)\langle 3, -4 \rangle = \left\langle \frac{9}{5}, -\frac{12}{5} \right\rangle$$

$$\textcircled{37} a = \langle 4, 2, 0 \rangle \quad b = \langle 1, 1, 1 \rangle$$

$$a \cdot b = 4 + 2 + 0 = 6$$

$$|a| = \sqrt{16+4} = 2\sqrt{5}$$

$$\text{scalar} = \frac{6}{2\sqrt{5}} = \frac{3}{\sqrt{5}}$$

$$\text{vector} = \frac{6}{4.5} \langle 4, 2, 0 \rangle$$

$$= \frac{3}{10} \langle 4, 2, 0 \rangle$$

$$= \left\langle \frac{6}{5}, \frac{3}{5}, 0 \right\rangle$$

$$\textcircled{39} a = i+k = \langle 1, 0, 1 \rangle \quad b = i-j = \langle 1, -1, 0 \rangle$$

$$a \cdot b = 1$$

$$|a| = \sqrt{2}$$

$$\text{scalar} = \frac{1}{\sqrt{2}}$$

$$\text{vector} = \frac{1}{2} \langle 1, 0, 1 \rangle$$

$$= \left\langle \frac{1}{2}, 0, \frac{1}{2} \right\rangle$$