Extra Problems

Online Problems

Problem 1 *Compute the following:*

$$(1, 2, 3) + (8, 3, 6) = \boxed{(9, 5, 9)}$$

$$4(1, -2, 4) = \boxed{(4, -8, 16)}$$

$$-12((5, 2, 6) - (8, 2, 4)) = \boxed{(36, 0, 24)}$$

Problem 2 *Let h be a constant. Compute the following:*

$$(7, 2, -1) + (2h, 0, h) = \boxed{(7 + 2h, 2, h - 1)}$$

$$h(1, 8, 2) = \boxed{(h, 8h, 2h)}$$

Problem 3 *For each of the following, determine whether the quantity exists or does not exist.*

$(1, 8, 3, 7) + (-1, 7, 2, 7)$

Multiple Choice:

(a) *Exists.* ✓

(b) *Does not exist.*

$(2, 8, 3) + (1, 7)$

Multiple Choice:

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(a) *Exists.*

(b) *Does not exist.* ✓

$(2, 7, 3) + 1$

Multiple Choice:

(a) *Exists.*

(b) *Does not exist.* ✓

$(2, 8, 3)(1, 7, 3)$

Multiple Choice:

(a) *Exists.*

(b) *Does not exist.* ✓

$2(7, 2, 3, 7, 2)$

Multiple Choice:

(a) *Exists.* ✓

(b) *Does not exist.*

Problem 4 *For points $P_1 = (2, -3, 7, 1)$ and $P_2 = (-1, 7, 2, 1)$, compute the displacement vector $P_1\vec{P}_2$.*

$$P_1\vec{P}_2 = \boxed{(-3, 10, -5, 0)}$$

Problem 5 *Write the vector $2\mathbf{i} - 5\mathbf{j} + 2\mathbf{k}$ in $\mathbb{R}^3$ in standard vector notation.*

$$2\mathbf{i} - 5\mathbf{j} + 2\mathbf{k} = \boxed{(2, -5, 2)}$$

Problem 6 *Compute the dot product.*

$$(1, 8, 3) \cdot (-2, 6, 0) = \boxed{46}$$

Problem 7 *Compute the projection of $\vec{v} = (1, 7, 3)$ onto $\vec{w} = (-3, -2, 1)$.*

$$\text{proj}_{\vec{w}}(\vec{v}) = \boxed{(7/2, 7/3, -7/6)}$$

Problem 8 *Compute the projection of the vector $\vec{v} = (1, 2, 3)$ onto the vector $\vec{w} = (-3, 2, -1)$.*

$$\text{proj}_{\vec{w}}(\vec{v}) = \boxed{(0, 0, 0)}$$

Problem 8.1 *Why does your answer make sense?*

Multiple Choice:

(a) *The vectors are parallel.*

(b) *The vectors are perpendicular.* ✓

(c) *They are the same length.*

Problem 9 *Compute the dot product.*

$$(1, -5, 0, 2) \cdot (2, -1, 4, 1) = \boxed{9}$$

Problem 10 *Compute the dot product.*

$$(1, 8, 3) \cdot (-3, 0, 1) = \boxed{0}$$

What can you conclude about the vectors?

Multiple Choice:

(a) *They're perpendicular.* ✓

(b) *They aren't perpendicular.*

Problem 11 *Compute the dot product.*

$$(1, 2, 3) \cdot (-3, -2, -1) = \boxed{-10}$$

What can you conclude about the vectors?

Multiple Choice:

(a) *They're perpendicular.*

(b) *They aren't perpendicular.* ✓

Problem 12 *Compute the dot product.*

$$(1, 8, 3, 6) \cdot (3, -3, -1, 4) = \boxed{-0}$$

What can you conclude about the vectors?

Multiple Choice:

(a) *They're perpendicular.* ✓

(b) *They aren't perpendicular.*

Problem 13 *For each expression, determine whether it exists or does not exist.*

$(2, 8, 3) \cdot (1, 8, 2, 4)$

Multiple Choice:

(a) *Exists.*

(b) *Does not exist.* ✓

$(2, 8, 3, 1, 8) \cdot (1, 8, 2, 4, 2)$

Multiple Choice:

(a) *Exists.* ✓

(b) *Does not exist.*

Problem 14 *Compute the angle between the vectors* $(2, 8)$ *and* $(-8, 2)$ *in degrees.*

$$\theta = \boxed{90}^\circ$$

Problem 15 *Compute the angle between the vectors* $(2, 1, 3, 1, 1)$ *and* $(-3, 1, 1, 1, -2)$ *in degrees.*

$$\theta = \boxed{104.48}^\circ$$

(Give your answer as a positive number to two decimal places.

Problem 16 *Suppose you have vectors* $\vec{v}$ *and* $\vec{w}$ *such that* $\|\vec{v}\| = 6$ *and* $\|\vec{w}\| = 2$*, and the angle between* $\vec{v}$ *and* $\vec{w}$ *is* $\frac{\pi}{4}$ *radians. Compute the dot product of* $\vec{v}$ *and* $\vec{w}$*.*

$$\vec{v} \cdot \vec{w} = \boxed{6\sqrt{2}}$$

Written Problems

Problem 17 *For any vector* $\vec{v}$ *in* $\mathbb{R}^n$*, prove that* $\vec{v} \cdot \vec{v} = \|\vec{v}\|^2$*.*

Problem 18 *Prove that vectors* $\vec{v}$ *and* $\vec{w}$ *in* $\mathbb{R}^n$ *are perpendicular if and only if* $\text{proj}_{\vec{w}}(\vec{v})$ *is the zero vector.*
