

CH. 12 REVIEW

MATH 2110Q – Fall 2015
Professor Hohn

Answers (not necessarily in order):

$$\begin{aligned} & -1/\sqrt{6}, \pi/3, 18, x = -2 + 2t, y = 2 - t, x + 1 = \frac{y + 1}{3} = z - 10, \\ & z = 4 + 5t, -4x + 3y + z = -14, \approx 417, \langle -196, 3.92 \rangle, x + 3y + z = 6, \\ & \langle 196, 3.92 \rangle (1, 4, 4), x + y + z = 4, 22/\sqrt{26}, x = 2 + t, y = -t, z = 4 + 2t, \\ & 750, 000\sqrt{3}, -1, 3\sqrt{35}, \langle 33, -21, 6 \rangle, \end{aligned}$$

1. Calculate the given quantity if $\vec{a} = \hat{x} + \hat{y} - 2\hat{z}$, $\vec{b} = 3\hat{x} - 2\hat{y} + \hat{z}$, $\vec{c} = \hat{y} - 5\hat{z}$.

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

(b) $\|\vec{b} \times \vec{c}\|$

(c) $\vec{a} \cdot (\vec{b} \times \vec{c})$

(d) $\vec{a} \times (\vec{b} \times \vec{c})$

(e) $\text{comp}_{\vec{a}} \vec{b}$

2. If $\vec{a} \cdot \vec{b} = \sqrt{3}$ and $\vec{a} \times \vec{b} = \langle 1, 2, 2 \rangle$, find the angle between \vec{a} and \vec{b} .

3. Find parametric equations for the line through $(-2, 2, 4)$ and perpendicular to the plane $2x - y + 5z = 12$.

4. Find an equation of a plane through $(3, -1, 1)$, $(4, 0, 2)$, and $(6, 3, 1)$.

5. Find the point in which the line with parametric equations $x = 2 - t$, $y = 1 + 3t$, $z = 4t$ intersects the plane $2x - y + z = 2$.

6. Find an equation of the plane through the line of intersection of the planes $x - z = 1$ and $y + 2z = 3$ and perpendicular to the plane $x + y - 2z = 1$.

7. Find the distance between the planes $3x + y - 4z = 2$ and $3x + y - 4z = 24$.

8. (a) Find an equation of the plane that passes through the points $A(2, 1, 1)$, $B(-1, -1, 10)$, and $C(1, 3, -4)$.

(b) Find symmetric equations for the line through B that is perpendicular to the plane in part (a).

(c) A second plane passes through $(2, 0, 4)$ and has normal vector $\langle 2, -4, -3 \rangle$. Show that the acute angle between the planes is approximately 43° .

(d) Find parametric equations for the line of intersection of the two planes.

Applications

9. A tow truck drags a stalled car along a road. The chain makes an angle of 30° with the road and the tension in the chain is 1500 N. How much work is done by the truck in pulling the car 1 km? (Watch your units)
10. A wrench 30 cm long lies along the positive y -axis and grips a bolt at the origin. A force is applied in the direction $\langle 0, 3, -4 \rangle$ at the end of the wrench. Find the magnitude of the force needed to supply 100 N·m of torque to the bolt. (Watch your units)

11. A clothesline is tied between two poles, 8 m apart. The line is quite taut and has negligible sag. When a wet shirt with a mass of 0.8 kg is hung at the middle of the line, the midpoint is pulled down 8 cm. Find the tension in each half of the clothesline. (Watch your units...also, gravity)

Bonus: Challenge Question

12. Suppose \vec{v}_1 and \vec{v}_2 are vectors with $\|\vec{v}_1\| = 2$ and $\|\vec{v}_2\| = 3$, and $\vec{v}_1 \cdot \vec{v}_2 = 5$. Let $\vec{v}_3 = \text{proj}_{\vec{v}_1} \vec{v}_2$, $\vec{v}_4 = \text{proj}_{\vec{v}_2} \vec{v}_3$, $\vec{v}_5 = \text{proj}_{\vec{v}_3} \vec{v}_4$, and so on. Compute $\sum_{n=1}^{\infty} \|\vec{v}_n\|$.