Math 2163

Jeff Mermin's section, Quiz 2, September 1

1. **(2 points each)** Indicate whether the following statements are true or false. ("True" means "Always true", "false" means "sometimes false" or "possibly false".) No justification is necessary. Write out the whole word "true" or "false".

   On these problems, a, b, c, p, q, and r are real numbers, P is a point, t is a variable, $\mathbf{v}$ and $\mathbf{w}$ are (nonzero) vectors, and x, y, and z are the usual rectangular coordinates for $\mathbb{R}^3$

   (a) If $\mathbf{v}$ is a direction vector for a line ℓ, then $2\mathbf{v}$ is also a direction vector for ℓ.

   (b) The line $(x, y, z) = (p, q, r) + t\langle a, b, c\rangle$ is contained in the plane with equation $a(x - p) + b(y - q) + c(z - r) = 0$.

   (c) $\mathbf{v}$ and $\mathbf{w}$ are perpendicular if and only if $\mathbf{v} \bullet \mathbf{w} = 0$.

   (d) The equations $(x, y, z) = (P + t\mathbf{v})$ and $(x, y, z) = P - t\mathbf{v}$ define the same line.

   (e) The planes $x + y + z = 2$ and $2x + 2x + 2z = 1$ are parallel.

2. **(4 points)** Compute the cross product

$$\langle 4, 0, -3\rangle \times \langle 0, 4, 2\rangle$$

3. **(6 points)** Find the equation for the plane that contains the points $P = (3, -1, 5)$, $Q = (4, -2, -3)$, and $R = (0, 1, -2)$

Extra Credit **(3 points)**: Suppose we know that $\mathbf{v} \times \mathbf{w} = \langle 1, 2, 3 \rangle$. Compute the following, or explain why we need more information.

(a) $(\mathbf{v} + \mathbf{w}) \times (\mathbf{v} - \mathbf{w})$.

(b) $(\mathbf{v} + \mathbf{w}) \bullet (\mathbf{v} - \mathbf{w})$.

(c) $(\mathbf{v} - \langle 1, 1, 1 \rangle) \times (\langle 1, 1, 1 \rangle - \mathbf{v})$