1. The set of points (x,y,z) such that $x-y+z=0$ is
   (a) a line
   (b) a plane
   (c) The empty set
   (d) hard to decipher

Determine whether the following lines are coinciding, parallel, intersecting, or skew using the direction vectors.

2. $x = 1+t$, $y = 4-t$, $z = 2+2t$ and $x = 3+\frac{t}{2}$, $y = 4-\frac{t}{2}$, $z = t-6$

3. $x = 3$, $y = 6+t$, $z = 4-t$ and $x = t$, $y = 4-t$, $z = 1+2t$

4. $x = 3t$, $y = 1+3t$, $z = 1-2t$ and $x = 3-6t$, $y = 4-6t$, $z = -1+4t$

5. $x = 1+2t$, $y = -3+t$, $z = 2$ and $x = 8+3t$, $y = t$, $z = 4+2t$

6. Let $\vec{a} = \langle -3, 1, 2\rangle$ and $\vec{b} = \langle 0, 1, -1\rangle$. Find $\vec{a} \times \vec{b}$ and verify that it is orthogonal to both $\vec{a}$ and $\vec{b}$

Use the right hand rule to find the following cross products.

7. $\hat{i} \times \hat{k}$

8. $\hat{k} \times (-\hat{j})$

9. $\hat{j} \times (-\hat{i})$

10. $\hat{j} \times \hat{k}$

11. $(-\hat{i}) \times \hat{k}$

12. $\hat{i} \times (-\hat{j})$

True or False

13. $(\vec{a} \times \vec{b}) \times \vec{c} = \vec{a} \times (\vec{b} \times \vec{c})$

14. $\vec{a} \times (\vec{b} + \vec{c}) = (\vec{a} \times \vec{b}) + (\vec{a} \times \vec{c})$

15. $\vec{a} \times \vec{b} = \vec{b} \times \vec{a}$

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

17. $(\vec{a} \cdot \vec{b}) \cdot \vec{c} = \vec{a} \cdot (\vec{b} \cdot \vec{c})$

18. $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$

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

20. $\vec{a} \times \vec{b} = -\vec{b} \times \vec{a}$

21. Consider a parallelopiped with adjacent edges $\vec{PQ}$, $\vec{PR}$, $\vec{PS}$ where $\vec{P} = \langle 0, 1, -1 \rangle$, $\vec{Q} = \langle 2, -2, 0 \rangle$ $\vec{R} = \langle 1, 2, 3 \rangle$ $\vec{S} = \langle -1, -1, -1 \rangle$. Find the area of the parallelopiped.

22. What vectors are perpendicular to the yz-plane?