Another Vector Review
(Quite Thorough!)

Name_____
Period_____Date_____

Let plane P1 be: $2x - y + 2z = 6$, let P2 be: $6x - 3y + 6z = 7$, and let P3 be: $3x + 12y - 4z = 24$.

Let Point $A = (2, 3, -4)$, let point $B = (-1, 0, 3)$, and let point $C = (4, -2, 1)$.

Let $\ell 1$ be $r = \langle 2, 1, 4\rangle + d\langle -1, 8, 4\rangle$, let $\ell 2$ be $x = 4 + 2t$, $y = -2 + 3t$ and $z = -6t$, and let $\ell 3$ be $\frac{x+4}{-2} = \frac{y}{-3} = \frac{z-12}{6}$

Let $\vec{r} = \langle -9, 2, 6\rangle$, let $\vec{s} = 5\vec{i} - 14\vec{j} - 2\vec{k}$, and let $\vec{u} = \langle 2, 6, -3\rangle$

1. Sketch P1.
2. Write the intercepts and traces of P3.
3. Write the unit normal vector to P2.
4. Find the distance between P1 and P2.
5. Write the line of intersection between P1 and P3.
6. Find the angle that P2 and P3 make when they intersect.
7. Write the equations of 2 planes that are each 5 units away from P3.
8. Find the point where $\ell 1$ intersects P1.
9. Write an equation of a line that is parallel to P2 that contains point A.
10. Write the equation of the line $\overleftrightarrow{AB}$.
11. Write the equation of the plane through A, B, and C.
12. Write the direction cosines of α, β, and γ for line $\overleftrightarrow{BC}$.
13. Write an equation of a line that is parallel to $\ell 2$ that contains C.
14. Are B and C on the same or opposite sides of P1? How do you know?
15. Find the distance between $\ell 2$ and point C.
16. Find the distance between $\ell 1$ and $\ell 2$.
17. How do you know that $\ell 2$ and $\ell 3$ are parallel?
18. Find the distance between $\ell 2$ and $\ell 3$.
19. Find the direction angles of $\ell 2$.
20. Find the area of triangle ABC.
21. Find the volume of the parallelepiped with edges at $\overline{OA}$, $\overline{OB}$, and $\overline{OC}$.
22. Find the vector projection of $\vec{r}$ onto $\vec{s}$.
23. Find the magnitude of $2\vec{r} + \vec{u}$
24. If $\overrightarrow{PA} = \vec{s}$, find the coordinates of P.
25. Find a vector that is parallel (perpendicular) to $\vec{s}$ and is 50 units long.
26. Find two points on $\ell 1$ that are 10 units from (2, 1, 4).
27. Write the equation of a sphere with diameter $\overline{AB}$.
28. Find the points of intersection of $(x - 2)^2 + y^2 + (z + 3)^2 = 144$ and $\ell 2$.
29. Find the volume of the tetrahedron with vertices at A, B, C, and the origin.

MORE FUN VECTOR PROBLEMS

Name_____
Period____Date_____

1. Write the equation of the line that passes through (-2,0,3) and is parallel to $\vec{v} = 2\vec{i} + 4\vec{j} - 2\vec{k}$.

2. Determine if the lines: $\vec{r} = (2 + 4d)\vec{i} + 3\vec{j} + (1 + d)\vec{k}$ and $\vec{s} = (2 + 2d)\vec{i} + (3 + 2d)\vec{j} + (1 + d)\vec{k}$ intersect. If they do, find the point of intersection. If not, find the distance between the lines.

3. Write the equation of the plane through the points (0,0,0), (1,2,3), and (-2,3,3).

4. Write the equation of the plane that passes through the points (2,2,1), and (-1,1,-1) and is perpendicular to the plane $2x - 3y + z = 3$.

5. Write the plane that contains the lines: $\vec{r} = (1-2d)\vec{i} + (4+d)\vec{j} + d\vec{k}$ and $\vec{s} = (2 - 3d)\vec{i} + (1 + 4d)\vec{j} + (2 - d)\vec{k}$.

6. Determine if the line $\vec{r} = (1/2 + d)\vec{i} + (-3/2 - d)\vec{j} + (-1 + 2d)\vec{k}$ lies in the plane $2x - 2y + z = 12$. If not, find the point of intersection of the line and the plane, or, if they are parallel, find the distance between them.

7. Prove that the quadrilateral with vertices (1,1,3), (-2,1,-1), (-5,4,0), and (-8,4,-4) is a parallelogram and find its area.

8. Find the volume of the parallelopiped having edges $\vec{PQ}$, $\vec{PR}$, and $\vec{PS}$ is P = (1,3,4), Q = (3,5,3), R = (2,1,6), and S = (2,2,5). (Find the area of the base and multiply that times the height.)

9. Find the exact value of the sine of the angle between $2\vec{i} + 3\vec{j} - 4\vec{k}$ and $-\vec{i} + \vec{j} + 3\vec{k}$ A) by using the cross product, and B) by using the dot product and appropriate trig identities.

10. Find the distance between $2x - 6y + 4z = 9$ and $x - 3y + 2z = 13$.

11. Find the distance between $\vec{r} = (2 + 6d/7)\vec{i} + (1 - 3d/7)\vec{j} + (- 2d/7)\vec{k}$ and $\vec{s} = (5 + 6d/7)\vec{i} + (-4 - 3d/7)\vec{j} + (3 - 2d/7)\vec{k}$.

ANSWERS: 1. $\vec{r} = (-2 + 2d)\vec{i} + (4d)\vec{j} + (3 - 2d)\vec{k}$, 2. They intersect at (2,3,1). 3. $3x + 9y - 7z = 0$ 4. $7x + y - 11z = 5$ 5. $x + y + z = 5$ 6. (2,-3,2) 7. 89 sq units