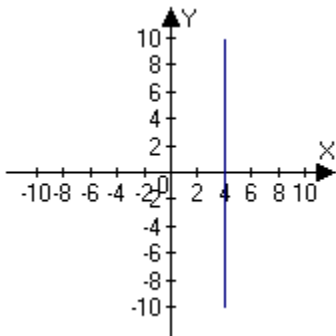Name: _____ Date: _____

1. For the given point in polar coordinates, find the corresponding rectangular coordinates for the point.

$$\left(3, \frac{\pi}{2}\right)$$

2. For the given point in rectangular coordinates, find two sets of polar coordinates for the point for $0 \le \theta \le 2\pi$.

$$\left(2\sqrt{3}, -2\right)$$

3. Match the graph with its polar equation.

A) $r = 4\sin\theta$
B) $r = 8\cos(4\theta)$
C) $r = 5(1+\cos\theta)$
D) $r = 4\sec\theta$
E) $r = 5(1+\sin\theta)$

4. Convert the rectangular equation to polar form.

$$x = 3$$

5. Convert the rectangular equation to polar form.

$$2x - y + 1 = 0$$

6. Convert the polar equation to rectangular form.

   $r = 2$

7. Convert the polar equation to rectangular form.

   $r = 4\sin\theta$

8. Find the points of intersection of the graphs of the equations.

   $r = 1 + \cos\theta$
   $r = 3\cos\theta$

9. Find the points of intersection of the graphs of the equations.

   $r = \dfrac{\theta}{1.9}$
   $r = 1.9$

10. Find the length of the curve over the given interval.

    $r = 6\cos\theta, \ -\dfrac{\pi}{2} \le \theta \le \dfrac{\pi}{2}$

11. Find the length of the curve over the given interval.

    $r = 7 + 7\sin\theta, \ 0 \le \theta \le 2\pi$

12. Find the length of the curve over the given interval.

    $r = 3(1 + \cos\theta), \ 0 \le \theta \le 2\pi$

13. Find vectors **u** and **v** whose initial and terminal points are given. Determine whether **u** and **v** are equivalent.

    u: (3,8), (8,10)   **v:** (5,3), (10,5)

14. Find the vector **v** whose initial and terminal points are given below.

(6,4), (11,2)

15. Find the vector **v** whose initial and terminal points are given below.

(3.7,7.7), (5.65,5.15)

16. Find (a) 6**u** (b) **v-u** (c) 1**u**+4**v** given the following values for **u** and **v** .

$$\mathbf{u} = \langle 3,8 \rangle, \quad \mathbf{v} = \langle 3,-2 \rangle$$

(a) 6**u**   (b) **v - u**   (c) 1**u**+4**v**

17. The vector **v** and its initial point is given. Find the terminal point.

$$\mathbf{v} = \langle -5,-4 \rangle, \quad \text{initial point } (5,10)$$

18. Find the magnitude of the vector given below.

$$\mathbf{v} = \langle 3,5 \rangle$$

19. Find the unit vector in the direction of **u**.

$$\mathbf{u} = \langle 2,3 \rangle$$

The possible solutions are given to two decimal places.

20. Given the vectors

$$\mathbf{u} = \langle 3, 4 \rangle, \quad \mathbf{v} = \langle -2, 5 \rangle$$

find the following:

(a) $\left\| \mathbf{u} + \mathbf{v} \right\|$

(b) $\left\| \dfrac{\mathbf{u}}{\left\| \mathbf{u} \right\|} \right\|$

(c) $\left\| \dfrac{\mathbf{u} + \mathbf{v}}{\left\| \mathbf{u} + \mathbf{v} \right\|} \right\|$

21. Find the component form of a vector $\mathbf{v}$ given its magnitude and the angle it makes with the positive x-axis.

$$\left\| \mathbf{v} \right\| = 4, \quad \theta = 240^\circ$$

22. Find the component form of a vector $\mathbf{v}$ given its magnitude of $\mathbf{u}$ and $\mathbf{u+v}$ and the angles that $\mathbf{u}$ and $\mathbf{u+v}$ make with the positive x-axis.

$$\left\| \mathbf{u} \right\| = 6, \quad \theta = 30^\circ, \quad \left\| \mathbf{u} + \mathbf{v} \right\| = 10, \quad \theta = 240^\circ$$

(The choices below are given to two decimal places.)

23. Three forces with magnitudes 85 pounds, 90 pounds and 25 pounds act on an object at angles 80°, -40°, and 90°, respectively, with the positive x-axis. Find the direction and magnitude of the resultant force.

(The choices below are given to two decimal places.)

24. Find the coordinates of the point that is located 5 units in front of the yz-plane, 7 units in front of the xz-plane, 3 units below the xy-plane.

25. Find the distance between the points given below.

(2 ,3, 1),   (6 ,5 , 7)

26. Find the coordinates of the midpoint of the line segment joining the points given below.

(–5 ,4, –2),   (–3 ,7 , 2)

27. Find the standard equation of the sphere with center (4 , 3, –4), and radius 4 .

28. Find the standard equation of a sphere that has diameter with the end points given below.

(1 , 4 , 1),   (3 , 6 , 9)

29. Complete the square to write the following equation in the standard equation of a sphere.

$$x^2 + y^2 + z^2 - 6x - 2y + 8z + 1 = 0$$

30. Find the component form of the vector **u** with the given initial and terminal points.

Initial point: (4 , 2 , 5)

Terminal point: (7 , –2 , 8)

31. Given the vector **v** and its initial point find the terminal point of the vector.

$\mathbf{v} = \langle -3, -3, 1 \rangle$,   initial point $(3, 5, -1)$

32. Find the vector **z**=4**v**+4**u**-5**w** given that:

$\mathbf{v} = \langle 5, -1, 6 \rangle$, $\mathbf{u} = \langle 3, -1, 5 \rangle$, $\mathbf{w} = \langle -5, -5, 6 \rangle$

33. Find the magnitude of the vector given below.

$\mathbf{v} = \langle 0, -2, -3 \rangle$

34. Find the magnitude of the vector **v** given its initial and terminal points.

Initial point: $(-3, -4, -6)$

Terminal point: $(-8, 1, -9)$

35. Find the unit vector in the direction of **u**.

$\mathbf{u} = \langle -5, -3, 4 \rangle$

The possible solutions are given to two decimal places.

36. Find (a) $\mathbf{u} \cdot \mathbf{v}$ (b) $(\mathbf{u} \cdot \mathbf{v}) \mathbf{v}$ (c) $\mathbf{u} \cdot (3\mathbf{v})$ given the vectors **u** and **v.**

$$\mathbf{u} = \langle 2, 7 \rangle, \quad \mathbf{v} = \langle 5, 5 \rangle$$

(a) $\mathbf{u} \cdot \mathbf{v}$ (b) $(\mathbf{u} \cdot \mathbf{v}) \mathbf{v}$ (c) $\mathbf{u} \cdot (3\mathbf{v})$

37. Find the angle between the vectors for **u** and **v** given below.

$$\mathbf{u} = \langle 1, 5 \rangle, \quad \mathbf{v} = \langle -3, -1 \rangle$$

38. Find the angle between the vectors for **u** and **v.**

$$\mathbf{u} = -4\mathbf{i} + 7\mathbf{j}, \quad \mathbf{v} = -5\mathbf{i} + 5\mathbf{j}$$

39. Determine whether **u** and **v** are orthogonal, parallel, or neither.

$$\mathbf{u} = \langle 20, 5 \rangle, \quad \mathbf{v} = \langle 3, -12 \rangle$$

40. Determine whether **u** and **v** are orthogonal, parallel, or neither.

$$\mathbf{u} = 12\mathbf{i} + 4\mathbf{j}, \quad \mathbf{v} = 5\mathbf{i} - 15\mathbf{j}$$

41. Determine whether **u** and **v** are orthogonal, parallel, or neither.

$$\mathbf{u} = \langle 4, 6 \rangle, \quad \mathbf{v} = \langle -12, -18 \rangle$$

42. Find the direction cosines of the vector **u** given below.

$$\mathbf{u} = \langle 6, 4, -5 \rangle$$

43. Find the direction cosines of the vector **u** given below.

$$\mathbf{u} = -4\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$$

44. Find the direction angles of the vector **u** given below.

$$\mathbf{u} = \langle 6, 2, 3 \rangle$$

45. Find the projection of **u** onto **v,** and the vector component of **u** orthogonal to **v**.

$$\mathbf{u} = \langle -7, 9 \rangle, \quad \mathbf{v} = \langle 7, 5 \rangle$$

    Projection of **u** onto **v**   Component of **u** orthogonal to **v**

46. Find the projection of **u** onto **v,** and the vector component of **u** orthogonal to **v**.

$$\mathbf{u} = \langle -1, 7, 5 \rangle, \quad \mathbf{v} = \langle 5, 10, 2 \rangle$$

    Projection of **u** onto **v**   Component of **u** orthogonal to **v**