

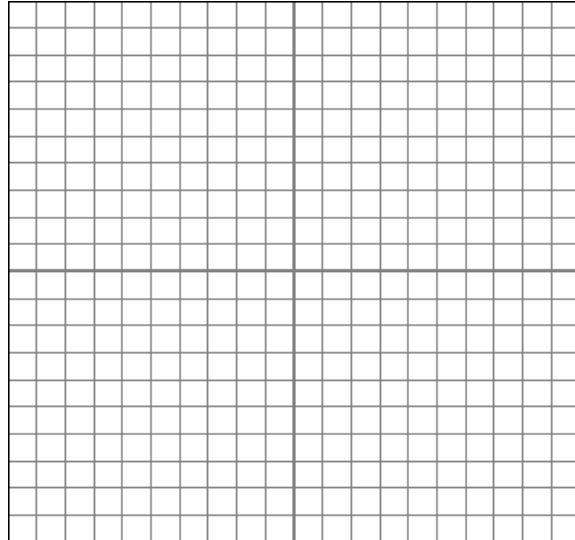
**Topics for Review**

sections are from the Demana textbook unless otherwise noted.

<p><b>Vectors, Parametric Equations, and Polar Coordinates</b>                  6.1 - 6.5 (Demana, omit projection of vectors and problems involving "work" in 6.2) + 12.1-12.6 (Brown)</p> <p><b>Conic Sections</b>                  8.1 - 8.3; 6.2 (Brown); 6.7 (Brown)</p>
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**Problems**

1. Vector  $\mathbf{v}$  is the directed line segment from  $(-7,1)$  to  $(5,-8)$ . Vector  $\mathbf{w}$  has component form  $\langle 2,5 \rangle$ .
  - a. Draw the vector  $\mathbf{w} + .5\mathbf{v}$  on the axes at right.
  - b. Use a vector method to find the angle between  $\mathbf{w}$  and  $\mathbf{v}$ .
  - c. Find a vector of magnitude 2 in the direction of  $\mathbf{v}$ .



- d. Find the coordinates of a point  $\frac{2}{5}$  of the way from  $(-7,1)$  to  $(5,-8)$ .
2. Consider circle,  $C$ , defined by the parametric equations:  $C: \begin{cases} x(t) = 2 + \cos t \\ y(t) = -3 + \sin t \end{cases}$ 
    - a. Write a Cartesian (rectangular) equation for  $C$  in standard form.
    - b. Ellipse  $E$  is formed by stretching  $C$  vertically by a factor of 3 and horizontally by a factor of 2. Find parametric and Cartesian equations for  $E$ .
  3. Construct parametric equations for a ray terminating in point  $(0,2)$  and passing through the point  $(3,0)$ .
  4. Let  $z = 1 + i$ .
    - a. Find  $z^8$  and  $|z|$ . Express your answers in  $r\text{cis}\theta$  form
    - b. Find the fourth roots of  $z$ . Express your answers in  $r\text{cis}\theta$  form.
  5. Find all solutions to the equation  $x^5 - 32 = 0$ . Plot the solutions in the complex plane.
  6. Fill in the conversion table below:

cartesian	convert	polar
$(-\frac{1}{2}, \frac{\sqrt{3}}{2})$	$\longrightarrow$	

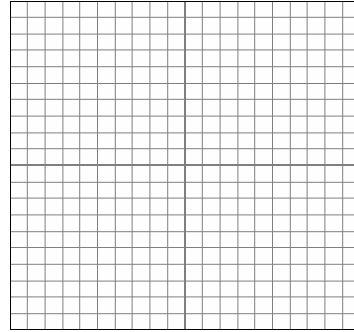
**Honors Advanced Math**  
Review 3

Name \_\_\_\_\_

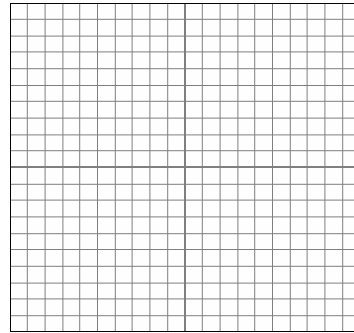
	←	$(4, \frac{5\pi}{6})$
$x^2 + y^2 = 12$	→	
	←	$r = 4 \csc \theta$

7. Each of the second-degree equations below represents a non-degenerate conic section. Rewrite each conic section in its standard form. Then draw a quick sketch of each conic.

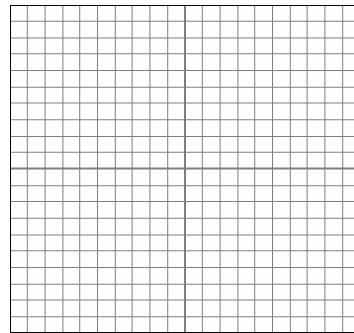
a.  $x^2 - 4y^2 - 2x + 16y - 19 = 0$



b.  $9x^2 + 16y^2 - 18x - 64y - 71 = 0$



c.  $y^2 - 6y + 16x + 25 = 0$



8. Line L goes through the points  $(-7, 2, -1)$  and  $(-9, 3, 2)$ .

a. Write the equation of line L in both vector form and parametric form.

b. Plane P is perpendicular to the vector  $\langle 3, -2, 1 \rangle$  and includes the point  $(4, 8, -1)$ .

Find the equation of plane P.

c. Find the intersection of line L and plane P or explain why there is no intersection.

9. A triangle is formed by the points  $A(-1,3,-2)$ ,  $B(5,1,3)$ , and  $C(6,4,5)$ .

- Find the measure of  $\angle BAC$ . Give your answer as a decimal.
- Find the area of  $\triangle ABC$ . Give your answer as a decimal.
- Write the equation of the plane formed by points  $A$ ,  $B$ , and  $C$ .

10. Consider the following lines:

$$l_1 : (x,y,z) = \langle -2, -4, 1 \rangle t + (1, 6, 5)$$

$$l_2 : (x,y,z) = \langle 1, 0, -5 \rangle s + (-2, -2, 2)$$

- Do these lines intersect? If they do, find the coordinates of the point of intersection. If they do not intersect, determine whether they are parallel or skew.
- In part a, you should have found that the lines did intersect. Find the acute angle formed by the two lines at their point of intersection.
- Find the equation of the plane formed by the two lines.

11. Consider the following three planes:

$$P_1 : 2x + 2y + z = -2$$

$$P_2 : 3x + 2z = -2$$

$$P_3 : -x + 5y - 2z = 1$$

- Find the intersection of the three planes. If the intersection is a point, give the coordinates of the point. If the intersection is a line, give the equation of the line. If there is no intersection, explain how you know.
- Find the intersection of  $P_1$  and  $P_2$ . If the intersection is a point, give the coordinates of the point. If the intersection is a line, give the equation of the line. If there is no intersection, explain how you know.

12. Consider the following linear transformation:

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 3 & 1 \\ 6 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

- Explain how you can tell that this transformation will map all points in the plane to single line.
- Find the equation of this line.