Unit 10.1-10.5 - Polars, Complex Numbers, and Vectors
By the end of this unit, you should be able to:

- plot points using polar coordinates
$\square$ convert between rectangular and polar coordinates

$\square$ transform equations between polar to rectangular form
$\square$ graph polar equations
$\square$ convert a complex number from rectangular form to polar form
$\square$ plot points in the complex plane
$\square$ find products and quotients of complex numbers in polar form
$\square$ use De Moivre's Theorem
$\square$ find complex roots
$\square$ graph vectors
$\square$ find a position vector
$\square$ add and subtract vectors algebraically
$\square$ multiply a vector by a scalar
$\square$ find the magnitude of a vector
$\square$ find a unit vector
$\square$ find a vector from its direction and magnitude
$\square$ find the dot product of two vectors
$\square$ find the angle between two vectors
$\square$ determine whether two vectors are parallel, orthogonal, or neither
$\square$ decompose a vector into two orthogonal vectors
$\square$ compute work
Assignments:
10.1 - Polar Coordinates - pg. 721 \#19-45odd, 55-61odd, 67, 69, 75, 79
10.2 - Polar Graphs - pg. 736 \#13, 17, 21, 25, 29-36, 37-49odd, 50
10.3 - Complex Polar Plane - pg. 744 \#11, 13, 23, 27, 33, 37, 41, 43, 49, 53, 57, 58
10.4 - Vectors - pg. 755 \#7, 9, 11, 27, 29, 33, 37, 39, 41, 45, 49
10.5 - The Dot Product - pg. 763 \#7, 9, 11, 19, 21, 25, 26, 29, 35

Review Problems

1. Plot the points.
a) $\left(-2, \frac{2 \pi}{3}\right)$
b) $\left(3,-300^{\circ}\right)$
2. Find the polar coordinates.
a) $\left(\frac{\sqrt{3}}{2},-\frac{1}{2}\right)$
b) $\left(-\frac{\sqrt{2}}{2},-\frac{\sqrt{2}}{2}\right)$
3. Find the rectangular coordinates
a) $\left(5, \frac{\pi}{2}\right)$
b) $\left(-1, \frac{3 \pi}{4}\right)$
4. Graph.
a) $\theta=\frac{9 \pi}{4}$
b) $r=3-3 \cos \theta$
c) $r=2+3 \sin \theta$
d) $r=2 \sin (2 \theta)$
5. Write the polar equation in rectangular form.
a) $r=5 \cos \theta$
b) $4=r \csc \theta$
(more on the back)
6. Given $z=2\left(\cos 20^{\circ}+i \sin 20^{\circ}\right)$ and $w=6\left(\cos 65^{\circ}+i \sin 65^{\circ}\right)$, find the following. Answer in polar form.
a) $z w$
b) $\frac{w}{z}$
c) $z^{6}$
7. Plot each complex number in the complex plane. Then find the complex roots in polar form as indicated.
a) $-8-8 i$ (complex cube roots)
b) $-16 i$ (complex fourth roots)
8. Let $P=(4,-2)$ and $Q=(1,2)$ and $\mathbf{w}=2 \mathbf{i}-\mathbf{j}$.
a) Vector $\mathbf{v}$ is represented by the directed line segment $\overrightarrow{P Q}$. Write $\mathbf{v}$ in the form $\mathbf{a i}+b \mathbf{j}$.
b) Graph $\mathbf{v}+\mathbf{w}$.
c) Find $w-3 v$.
d) Find $\|\vec{w}\|$.
e) Find $\mathbf{v} \cdot \mathbf{w}$.
f) Find the angle between $\mathbf{v}$ and $\mathbf{w}$.
g) Find the projector vector $\mathbf{v}_{1}$ of $\mathbf{v}$ onto $\mathbf{w}$.
h) Find the unit vector that is in the same direction as vector $\mathbf{v}$.
9. Determine whether $\mathbf{v}$ and $\mathbf{w}$ are parallel, orthogonal, or neither.
a) $\mathbf{v}=2 \mathbf{i}+3 \mathbf{j} ; \mathbf{w}=-4 \mathbf{i}-6 \mathbf{j}$
b) $\mathbf{v}=3 \mathbf{i}-4 \mathbf{j} ; \mathbf{w}=-3 \mathbf{i}+4 \mathbf{j}$
c) $\mathbf{v}=3 \mathbf{i}-2 \mathbf{j} ; \mathbf{w}=4 \mathbf{i}+6 \mathbf{j}$
10. A cargo ship has a speed of 20 miles per hour bearing $\mathrm{S} 60^{\circ} \mathrm{W}$. The constant water current is 8 miles per hour in the direction $\mathrm{S} 60^{\circ} \mathrm{E}$. What is the actual speed (relative to land) of the boat?
11. A wagon is pulled horizontally by exerting a force of 32 pounds on the handle at an angle of $50^{\circ}$ to the horizontal. How much work is done in moving the wagon 40 feet?
