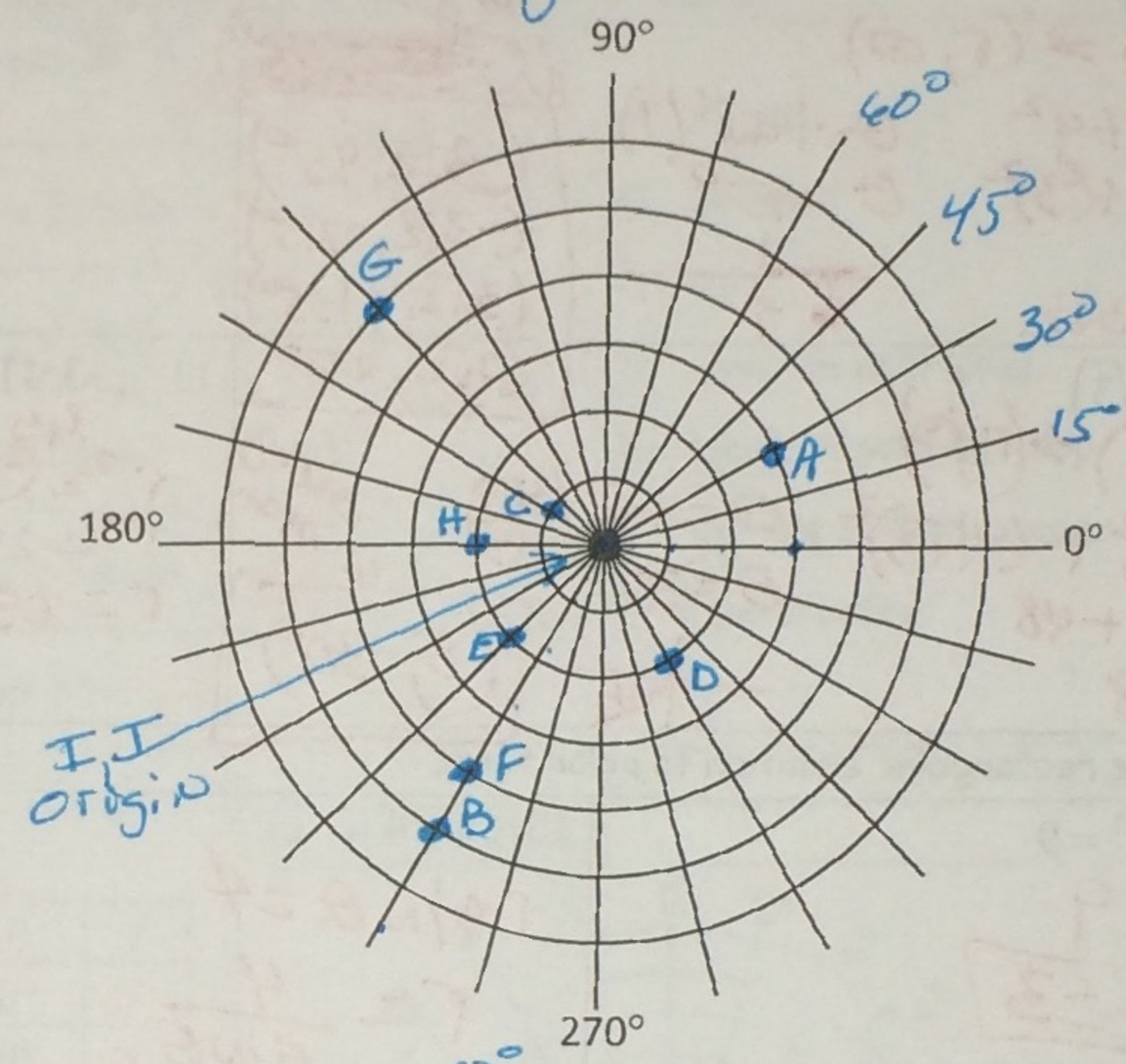
Pre-Calculus Worksheet
#16 Polar Coordinates

Name: Key

1. Graph and label each point.

$A(3,30^\circ)$ ✓	$B(5,240^\circ)$ ✓
$C(1,135^\circ)$ ✓	$D(2,-60^\circ)$ ✓
$E(-2,45^\circ)$ ✓	$F(-4,300^\circ)$ ✓
$G(-5,-45^\circ)$ ✓	$H(-2,0^\circ)$ ✓
$I(0,-270^\circ)$ origin	$J(0,0^\circ)$



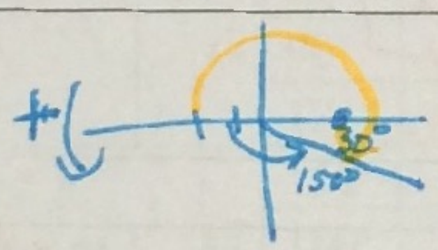
State three other pairs of polar coordinates for each point where ~~-360°~~ $-0^\circ < \theta < 360^\circ$. Show work.

2. $(-2,150^\circ)$

$(-2,210^\circ)$

$(2,-30^\circ)$

$(2,330^\circ)$

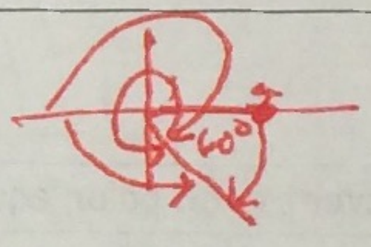


3. $(5,-60^\circ)$

$(5,300^\circ)$

$(-5,120^\circ)$

$(-5,-240^\circ)$

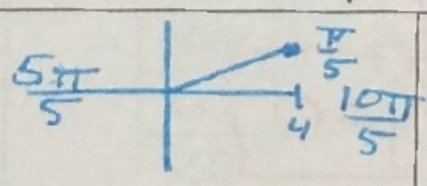


State three other pairs of polar coordinates for each point where ~~-2π~~ $0 < \theta < 2\pi$. Show work.

4. $\left(4,\frac{\pi}{5}\right)$

$\left(4,-\frac{9\pi}{5}\right)$

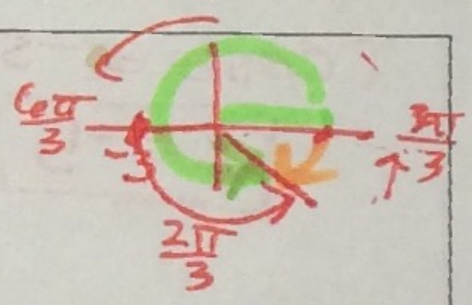
$\left(-4,\frac{6\pi}{5}\right)$ $\left(-4,-\frac{4\pi}{5}\right)$



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

$\left(-3,-\frac{4\pi}{3}\right)$

$\left(3,-\frac{\pi}{3}\right)$ $\left(3,\frac{5\pi}{3}\right)$



A point in polar coordinates is given. Convert the point to rectangular coordinates. Show work.

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

$(r,\theta) \Rightarrow (x,y)$

$x = r\cos\theta$ $y = r\sin\theta$

$x = 3\cos\frac{\pi}{2}$ $y = 3\sin\frac{\pi}{2}$

$x = 3(0)$ $y = 3(1)$

$x = 0$ $y = 3$

$(0,3)$

7. $\left(-1,\frac{5\pi}{4}\right)$

$(r,\theta) \Rightarrow x, y$

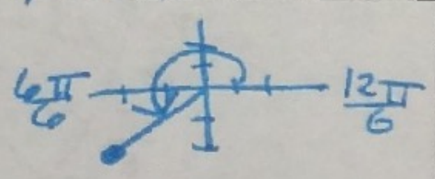
$x = -1\left(\cos\frac{5\pi}{4}\right)$ $y = -1\left(\sin\frac{5\pi}{4}\right)$

$x = -1\left(-\frac{\sqrt{2}}{2}\right)$ $y = -1\left(-\frac{\sqrt{2}}{2}\right)$

$x = \frac{\sqrt{2}}{2}$ $y = \frac{\sqrt{2}}{2}$

$\left(\frac{\sqrt{2}}{2},\frac{\sqrt{2}}{2}\right)$

8. $\left(2,\frac{7\pi}{6}\right)$



$\left(2,-\frac{5\pi}{6}\right)$

$\left(-2,\frac{\pi}{6}\right)$ $\left(-2,-\frac{11\pi}{6}\right)$

9. $(-2.5,1.1)$

Use a calculator. omit

A point in **rectangular** coordinates is given. Convert the point to **polar** coordinates. Show work.

10. $(-3,-3)$

$(x,y) \Rightarrow (r,\theta)$

$r^2 = x^2 + y^2$

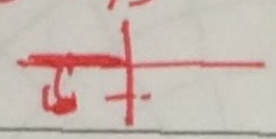
$r^2 = (-3)^2 + (-3)^2$

$r^2 = 18$

$r = \pm 3\sqrt{2}$

$\theta = \tan^{-1}(1)$

$\theta = 45^\circ$



any one

$(-3\sqrt{2}, 45^\circ)$

$(-3\sqrt{2}, -315^\circ)$

$(3\sqrt{2}, -135^\circ)$

$(3\sqrt{2}, 2250^\circ)$

11. $(-6,0)$

$(-6, 0^\circ)$

12. $(4, -4\sqrt{3})$

$(x,y) \rightarrow (r,\theta)$

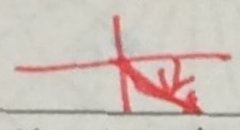
$r^2 = (4)^2 + (-4\sqrt{3})^2$

$r^2 = 16 + 48$

$r = \pm 8$

$\theta = \tan^{-1}\left(\frac{-4\sqrt{3}}{4}\right)$

$\theta = -30^\circ$



one of many

$(8, -30^\circ)$

13. ~~$(-3,4)$~~ Omit

x, y

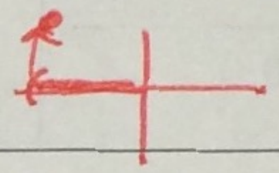
$r^2 = (-3)^2 + 4^2$

$r^2 = 25$

$r = \pm 5$

$\theta = \tan^{-1}\left(\frac{4}{-3}\right)$

$\theta \approx -53^\circ$



$(-5, -53^\circ)$

Convert the rectangular equation to polar form.

14. $x^2 + y^2 = 9$

$r^2 = 9$

$r = \pm 3$

15. $y = 4$

$r\sin\theta = 4$

$r = \frac{4}{\sin\theta}$

$r = 4\csc\theta$

16. $y = x$

$\frac{r\sin\theta}{r\cos\theta} = \frac{r\cos\theta}{r\cos\theta}$

$\tan\theta = 1$

$\theta = 45^\circ$

Convert each polar equation to rectangular form.

17. $r = -5\sec\theta$

$\frac{r}{1} = \frac{-5}{\cos\theta}$

$r\cos\theta = -5$

$x = -5$

18. $r = 4\sin\theta$

$r^2 = 4 \cdot r\sin\theta$

$x^2 + y^2 = 4y$

$x^2 + y^2 - 4y = 0$

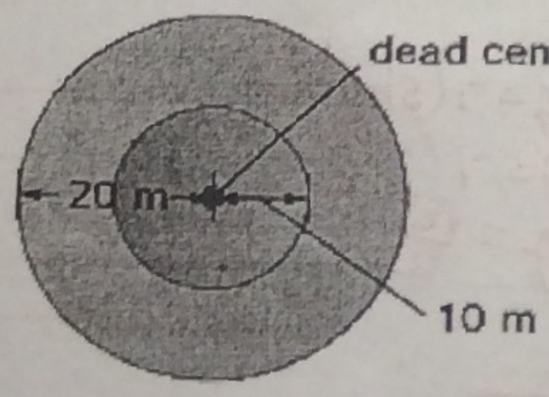
19. $r = 4$

$r^2 = 16$

$x^2 + y^2 = 16$

Solve each problem

20. In competitive accuracy landing, skydivers attempt to land as near as possible to "dead center", the center of a target marked by a disk 2 meters in diameter.



A) Write polar equations representing the 3 target boundaries.

$r = 2$

$r = 10$

$r = 20$

B) Graph the equations.