## Rectangular & Polar Form of Complex #s p. 77

**Rectangular Form of a complex #:** a + bi

**Polar Form of a complex #:** $r(\cos\theta + i\sin\theta)$

magnitude direction

### Converting from rectangular to polar form:

$$r = \sqrt{(a)^2 + (b)^2} \qquad \theta = \tan^{-1}\left(\frac{b}{a}\right)$$

1. $3 + 3\sqrt{3}i$ (a = 3, b = $3\sqrt{3}$)

$r = \sqrt{(3)^2 + (3\sqrt{3})^2}$ ($9 \cdot 3$)

$r = \sqrt{9 + 27}$

$r = \sqrt{36}$

$r = 6$

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

$\theta = 60°$ look at quadrant

QI, $3 + 3\sqrt{3}i$

$6(\cos 60° + i \sin 60°)$

Q2 → 3 add 180°

Q4 add 360°

2. $-\sqrt{3} + 1i$ ($a = -\sqrt{3}$, $b = 1$)

$r = \sqrt{(-\sqrt{3})^2 + (1)^2}$

$r = \sqrt{4}$

$r = 2$

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

$\theta = -30° + 180°$

$\theta = 150°$

Q2, 180°

$2(\cos 150° + i \sin 150°)$

3. $-\sqrt{2} - \sqrt{2}i$

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

$r = \sqrt{2 + 2} = \sqrt{4}$

$r = 2$

$\theta = \tan^{-1}\left(\frac{-\sqrt{2}}{-\sqrt{2}}\right)$

$\theta = 45° + 180°$

$\theta = 225°$

Q3

$2(\cos 225° + i \sin 225°)$

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## Converting from polar to rectangular form: p.78

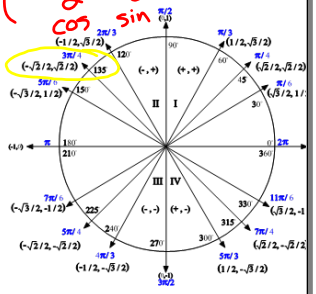
$x = r\cos\theta$ $y = r\sin\theta$

- You can find the coordinates for the angle on your unit circle
- Plug in the coordinates & distribute r.
- Simplify when needed.

Express each complex # in rectangular form:

1. $2\left(\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4}\right)$

$\frac{3\pi}{4} \rightarrow \left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$ cos sin

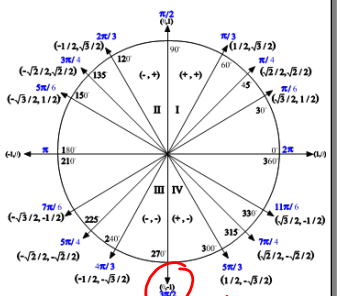


$2\left(-\frac{\sqrt{2}}{2} + i\frac{\sqrt{2}}{2}\right)$

$-\frac{2\sqrt{2}}{2} + \frac{2i\sqrt{2}}{2}$

$-\sqrt{2} + i\sqrt{2}$

2. $\sqrt{2}\left(\cos\frac{3\pi}{2} + i\sin\frac{3\pi}{2}\right)$



$\sqrt{2}\left(0 + i(-1)\right)$

$0 - \sqrt{2}i$

$(0, -1)$ cos sin

3. $4\left(\cos\frac{11\pi}{6} + i\sin\frac{11\pi}{6}\right)$

$\frac{11\pi}{6} \rightarrow \left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$ cos sin

$4\left(\frac{\sqrt{3}}{2} + i\left(-\frac{1}{2}\right)\right)$

$2\sqrt{3} - 2i$

$\frac{24\sqrt{3}}{8} - \frac{4}{2}$

4. $2.5(\cos 55° + i\sin 55°)$

* since 55° isn't on the unit circle, you can use your calc.

$2.5\cos 55° + 2.5\sin 55°\, i$

$1.4 + 2i$

$\frac{17\pi}{10} \cdot \frac{180}{\pi} = 306°$

$\frac{11\pi}{4} - \frac{2\pi}{1}$

$\frac{3\pi}{4}$

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