

Complex Numbers and Polar Form

Find the absolute value.

1) $3 + 4i$

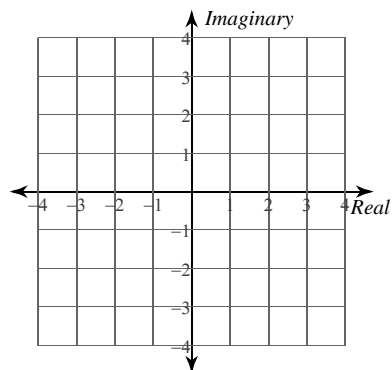
2) $-\sqrt{15} + i\sqrt{15}$

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

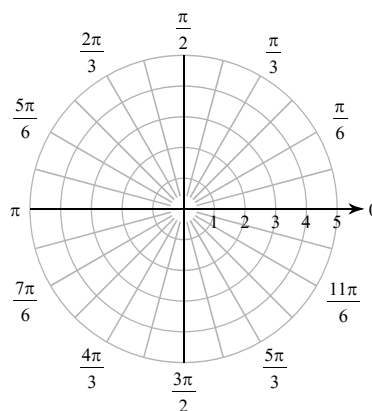
4) $\sqrt{21}\left(\cos \frac{\pi}{2} + i\sin \frac{\pi}{2}\right)$

Plot each point in the complex plane. Use rectangular coordinates when the number is given in rectangular form and polar coordinates when polar form is used.

5) $1 + 3i$



6) $3\left(\cos \frac{7\pi}{6} + i\sin \frac{7\pi}{6}\right)$

**Convert numbers in rectangular form to polar form and polar form to rectangular form.**

7) $-2\sqrt{3} - 2i$

8) $\sqrt{21} + i\sqrt{7}$

9) $-\frac{5\sqrt{2}}{2} - \frac{5\sqrt{2}}{2}i$

10) $2i$

11) $\sqrt{6}\left(\cos \frac{\pi}{2} + i\sin \frac{\pi}{2}\right)$

12) $2\left(\cos \frac{4\pi}{3} + i\sin \frac{4\pi}{3}\right)$

13) $\sqrt{3}\left(\cos \frac{\pi}{6} + i\sin \frac{\pi}{6}\right)$

14) $\sqrt{30}(\cos \pi + i\sin \pi)$

Simplify. Write your answer in rectangular form when rectangular form is given and in polar form when polar form is given.

15) $(4 + 4i)(5 - 3i)$

16) $4\sqrt{2}\left(\cos \frac{7\pi}{4} + i\sin \frac{7\pi}{4}\right) \cdot 2\left(\cos \frac{\pi}{6} + i\sin \frac{\pi}{6}\right)$

17) $\frac{6 - 2i}{2 + 4i}$

18) $\frac{2\sqrt{6}\left(\cos \frac{7\pi}{6} + i\sin \frac{7\pi}{6}\right)}{6\left(\cos \frac{11\pi}{6} + i\sin \frac{11\pi}{6}\right)}$

19) $(-1 - 6i)^3$

20) $\left(2\left(\cos \frac{7\pi}{6} + i\sin \frac{7\pi}{6}\right)\right)^3$

Find all n th roots. Write your answers in rectangular form when rectangular form is given and in polar form when polar form is given.

21) $2i, n = 3$

22) $6\left(\cos \frac{3\pi}{4} + i\sin \frac{3\pi}{4}\right), n = 4$

Critical thinking questions:

23) Show that $-i\sqrt[23]{n}$ is a 23rd root of ni .

24) Solve for $x : (2 + i)x = 1 + 2i$
Hint: x is a complex number.

Complex Numbers and Polar Form

Find the absolute value.

1) $4 + 3i$

5

2) $-\sqrt{15} + i\sqrt{15}$

 $\sqrt{30}$

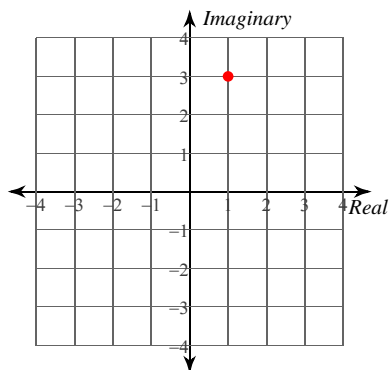
3) $3\left(\cos \frac{3\pi}{2} + i\sin \frac{3\pi}{2}\right)$

3

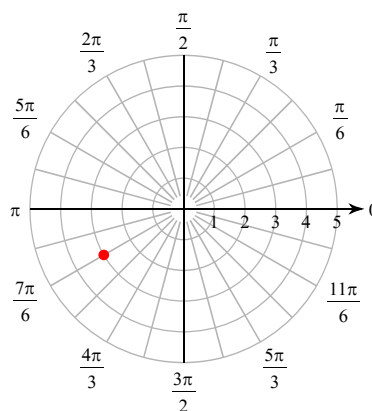
4) $\sqrt{21}\left(\cos \frac{\pi}{2} + i\sin \frac{\pi}{2}\right)$

 $\sqrt{21}$ **Plot each point in the complex plane. Use rectangular coordinates when the number is given in rectangular form and polar coordinates when polar form is used.**

5) $1 + 3i$



6) $3\left(\cos \frac{7\pi}{6} + i\sin \frac{7\pi}{6}\right)$

**Convert numbers in rectangular form to polar form and polar form to rectangular form.**

7) $-2\sqrt{3} - 2i$

$4\left(\cos \frac{7\pi}{6} + i\sin \frac{7\pi}{6}\right)$

8) $\sqrt{21} + i\sqrt{7}$

$2\sqrt{7}\left(\cos \frac{\pi}{6} + i\sin \frac{\pi}{6}\right)$

9) $-\frac{5\sqrt{2}}{2} - \frac{5\sqrt{2}}{2}i$

$5\left(\cos \frac{5\pi}{4} + i\sin \frac{5\pi}{4}\right)$

10) $2i$

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

11) $\sqrt{6}\left(\cos \frac{\pi}{2} + i\sin \frac{\pi}{2}\right)$

 $i\sqrt{6}$

12) $2\left(\cos \frac{4\pi}{3} + i\sin \frac{4\pi}{3}\right)$

 $-1 - i\sqrt{3}$

$$13) \sqrt{3} \left(\cos \frac{\pi}{6} + i \sin \frac{\pi}{6} \right)$$

$$\frac{3}{2} + \frac{\sqrt{3}}{2}i$$

$$14) \sqrt{30}(\cos \pi + i \sin \pi)$$

$$-\sqrt{30}$$

Simplify. Write your answer in rectangular form when rectangular form is given and in polar form when polar form is given.

$$15) (4 + 4i)(5 - 3i)$$

$$32 + 8i$$

$$16) 4\sqrt{2} \left(\cos \frac{7\pi}{4} + i \sin \frac{7\pi}{4} \right) \cdot 2 \left(\cos \frac{\pi}{6} + i \sin \frac{\pi}{6} \right)$$

$$8\sqrt{2} \left(\cos \frac{23\pi}{12} + i \sin \frac{23\pi}{12} \right)$$

$$17) \frac{6 - 2i}{2 + 4i}$$

$$\frac{1}{5} - \frac{7}{5}i$$

$$18) \frac{2\sqrt{6} \left(\cos \frac{7\pi}{6} + i \sin \frac{7\pi}{6} \right)}{6 \left(\cos \frac{11\pi}{6} + i \sin \frac{11\pi}{6} \right)}$$

$$\frac{\sqrt{6}}{3} \left(\cos -\frac{2\pi}{3} + i \sin -\frac{2\pi}{3} \right)$$

$$19) (-1 - 6i)^3$$

$$107 + 198i$$

$$20) \left(2 \left(\cos \frac{7\pi}{6} + i \sin \frac{7\pi}{6} \right) \right)^3$$

$$8 \left(\cos \frac{7\pi}{2} + i \sin \frac{7\pi}{2} \right)$$

Find all n th roots. Write your answers in rectangular form when rectangular form is given and in polar form when polar form is given.

$$21) 2i, n = 3$$

$$1.09 + 0.63i$$

$$-1.09 + 0.63i$$

$$-1.26i$$

$$22) 6 \left(\cos \frac{3\pi}{4} + i \sin \frac{3\pi}{4} \right), n = 4 \quad \sqrt[4]{6} \left(\cos \frac{3\pi}{16} + i \sin \frac{3\pi}{16} \right)$$

$$\sqrt[4]{6} \left(\cos \frac{11\pi}{16} + i \sin \frac{11\pi}{16} \right)$$

$$\sqrt[4]{6} \left(\cos \frac{19\pi}{16} + i \sin \frac{19\pi}{16} \right)$$

$$\sqrt[4]{6} \left(\cos \frac{27\pi}{16} + i \sin \frac{27\pi}{16} \right)$$

Critical thinking questions:

$$23) \text{ Show that } -i\sqrt[23]{n} \text{ is a 23rd root of } ni.$$

$$\left(-i\sqrt[23]{n} \right)^{23} = (-i)^{23} \cdot \left(\sqrt[23]{n} \right)^{23} = in$$

$$24) \text{ Solve for } x : (2 + i)x = 1 + 2i \quad \frac{4}{5} + \frac{3}{5}i$$

Hint: x is a complex number.