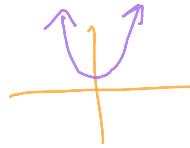
4.3

Date: 10/31/23 Section:



no x-intercepts
zeros are imaginary

Objective: I can find complex zeros.

Review:

Difference of Squares: $\boldsymbol{a^2 - b^2 = (a+b)(a-b)}$ Examples: Factor completely. $x^2 - 49$ $= \cancel{(x+2)(x-2)}$ $(x-7)(x+7)$ $9x^2 - 16$ $= (3x+4)(3x-4)$	**Remember:** $\boldsymbol{i = \sqrt{-1}}$ ex $\sqrt{-4} = 2i$ **and** $\boldsymbol{i^2 = -1}$ $4i^2 = -4$ $i \cdot i = \sqrt{-1} \cdot \sqrt{-1} = \sqrt{-1 \cdot -1}$

You may have been told that a sum of squares such as $a^2 + 4$ is not factorable.
But it is factorable, just not with real numbers.

$a^2 + 4 = 0$
$\sqrt{a^2} = \sqrt{-4}$
$a = \pm 2i$

Sum of Squares:
$\boldsymbol{a^2 + b^2} = a^2 - i^2 b^2$
$= (a)^2 - (ib)^2$
$= \boldsymbol{(a+ib)(a-ib)}$

$\boxed{\textbf{Sum of Squares: } \boldsymbol{a^2 + b^2 = (a+ib)(a-ib)}}$

So… $\boldsymbol{x^2 + 4} = x^2 - i^2 \cdot 2^2$
$= (x)^2 - (i \cdot 2)^2$
$= (x + 2i)(x - 2i)$

Now you try- Factor Completely:

1. $x^2 + 9$
$(x+3i)(x-3i)$

2. $y^2 + 25$
$(y+5i)(y-5i)$

3. $16a^2 + 4$
$\cancel{(4a-2i)(4a+2i)}$
$4(4a^2+1)$
$4(2a+i)(2a-i)$

4. $36b^2 + 1$

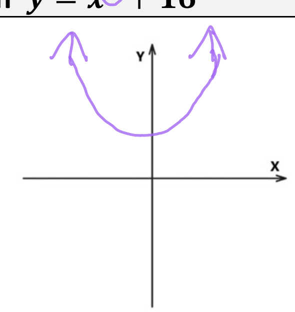
5. $m^2 + 49n^2$

Find the zeros by solving. What do those zeros look like on the graph and why?

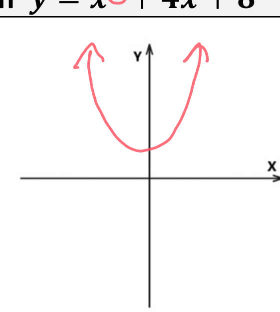
1. $\boldsymbol{y = x^2 + 16}$
$(x+4i)(x-4i) = 0$
$x = -4i, 4i \rightarrow$ zeros
imag

2. $\boldsymbol{y = x^2 + 4x + 8}$ Q.F.
$x = \dfrac{-4 \pm \sqrt{(4)^2 - 4(1)(8)}}{2(1)}$
$x = \dfrac{-4 \pm \sqrt{-16}}{2}$
$x = \dfrac{-4 \pm 4i}{2}$
$x = -2 \pm 2i$ complex zeros

Sketch $\boldsymbol{y = x^2 + 16}$



Sketch $\boldsymbol{y = x^2 + 4x + 8}$



2. $y = 8x^3 + 1$

$(2x+1)(4x^2-2x+1)=0$

$2x+1=0$

$2x=-1$

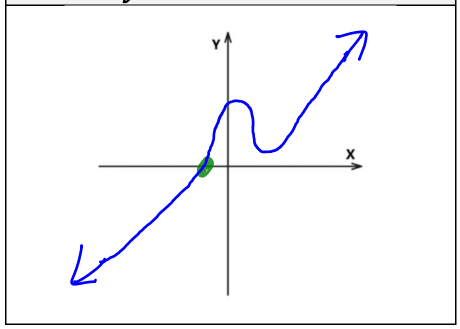
$x=-\frac{1}{2}$

real zero & x-int

$4x^2-2x+1=0$

↓ QF imag

Sketch $y = 8x^3 + 1$



$$x = \frac{+2 \pm \sqrt{(-2)^2-4(4)(1)}}{2(4)}$$

$$x = \frac{2 \pm \sqrt{-12}}{8}$$

$\sqrt{12}$ → 4, 3 → 2, 2

$$x = \frac{2 \pm 2\sqrt{3}\,i}{8}$$

$$x = \frac{1 \pm \sqrt{3}\,i}{4}$$

zeros - complex