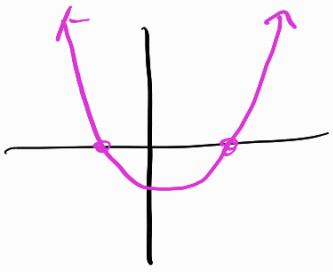
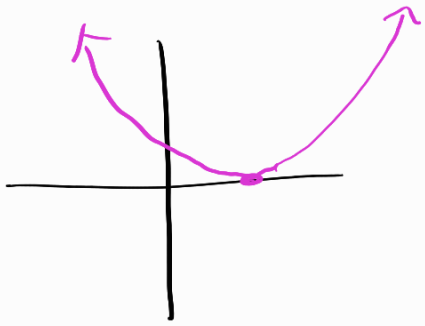
11/2/2023 So far...



$b^2 - 4ac > 0$

2 x-int

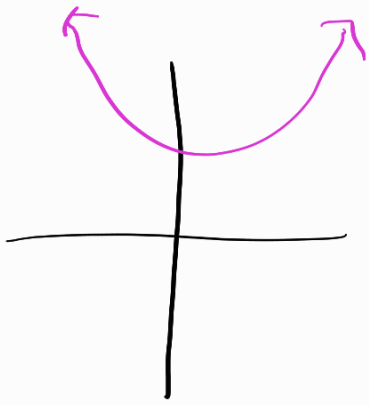
factorable!



$b^2 - 4ac = 0$

1 x-int

factorable



$b^2 - 4ac < 0$

no x-int

not factorable!

Real quadratic $\longleftrightarrow$ $\mathbb{R}$

$$2x^2 + \pi x + 2023$$

$a = 2$, $b = \pi$, $c = 2023$

Complex Numbers $\mathbb{C}$

"imaginary numbers"

$a + bi$ $\quad a, b$ are real #'s (constants)

"What is i"?

$i^2 = -1 \longrightarrow \sqrt{-1} = i$

$$\sqrt{20} = \sqrt{4}\sqrt{5} = 2\sqrt{5}$$

$$\sqrt{-16} = \sqrt{-1}\sqrt{16}$$

$$= \sqrt{16}\, i = \underline{4i}$$

$$\sqrt{-24} = \sqrt{24} \cdot i$$

$$= \sqrt{4}\sqrt{6}\, i$$

$$= 2\sqrt{6}\, i$$

$$f(x) = x^2 - 4x + 13$$

- Find discriminant.... $b^2 - 4ac$

-36 => no x-int...

using i

$$x^2 - 4x + 13 = 0$$

$$x = \frac{4 \pm \sqrt{-36}}{2} = \frac{4 \pm 6i}{2}$$

$$x = \frac{4}{2} + \frac{6i}{2}, \frac{4}{2} - \frac{6i}{2}$$

$$2+3i, \quad 2-3i$$

$$x^2 - 4x + 13 = (x - (2+3i))(x - (2-3i))$$

using complex #'s, factor

$x^2 + 6x + 25 = 0$ ① plug into Q. formula

$$x = \frac{-6 \pm \sqrt{36 - 4(25)}}{2(1)}$$

② rewrite answer as $(x - z)(x - w)$ ← factors

$$= \frac{-6 \pm \sqrt{-64}}{2} = \frac{-6 \pm 8i}{2}$$

$$= -\frac{6}{2} + \frac{8i}{2}, \; -\frac{6}{2} - \frac{8i}{2}$$

$-3 + 4i$, $-3 - 4i$

$f(x) = (x - (-3+4i))(x - (-3-4i))$

Complex Algebra

$z = 3 + 2i$

$i^2 = -1$

$w = 2 - 5i$

- $z + w = (3 + 2i) + (2 - 5i)$

$= 5 - 3i$

- $z - w = (3 + 2i) - (2 - 5i)$

$= 3 + 2i - 2 + 5i$

$= 1 + 7i$

$z \cdot w = (3 + 2i) \cdot (2 - 5i)$

$= 6 - 15i + 4i - 10i^2$

$= 6 - 11i - 10(-1)$

$= 6 + 10 - 11i$

$= 16 - 11i$

$$(1-2i)\cdot(3+4i) = 3+4i$$
$$-6i-8i^2$$

$$= 3+8-2i$$

$$= 11-2i$$

$z = 1-2i$ $\quad \bar{z} = 1+2i$

$3+4i$ $\quad \overline{3+4i} = 3-4i$

$5-23i$ $\quad \overline{5-23i} = 5+23i$

3 $\quad \bar{3} = 3$

$-2i$ $\quad \overline{-2i} = 2i$

$z = 3+4i$

$\bar{z} = 3-4i$

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

$$(a+b)(a-b) = a^2 - (b^2)$$

$$= 9 - 4i \cdot 4i$$

$$= 9 - -16$$

$$= 9 + 6$$

$$z = 3 + 2i$$

$$w = 2 - 5i$$

$$\frac{z}{w} = \frac{3+2i}{(2-5i)}\left(\frac{2+5i}{2+5i}\right)$$

$$= \frac{(3+2i)(2+5i)}{(2-5i)(2+5i)} = \frac{6+15i+4i+10i^2}{2^2 - -5i^2}$$

$$= \frac{6+10+19i}{}$$

$4+25$

$\Rightarrow \frac{16}{29} + \frac{19}{29} i$

a b

$\frac{3-4i}{1+2i} = a+bi$, for some reals a, b.

Find a, b.