Rewind

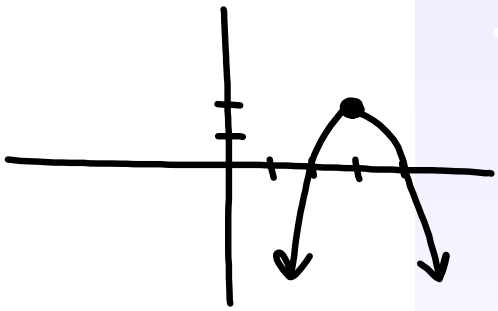
Given the graph, identify the following characteristics:

1) Vertex

2) Domain

3) Range

Challenge: Interval of increase



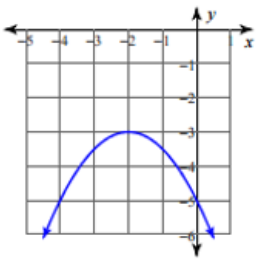
Into which group does each number go?

	Natural	Whole	Integers	Rational	Irrational	Real	Imaginary	Complex
22.5				✓		✓		✓
3/8				✓		✓		✓
$\sqrt[3]{14}$					✓	✓		✓
4-7i								✓
13i							✓	✓
-18			✓	✓		✓		✓
$\sqrt{-18}$							✓	✓
2i-18.4								✓
0		✓	✓	✓		✓		✓
9/4				✓		✓		✓

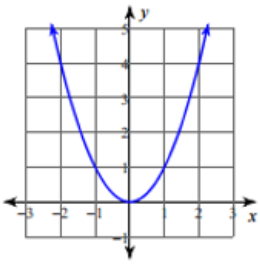
Answers from yesterday

...and complete the next 6 graphs.

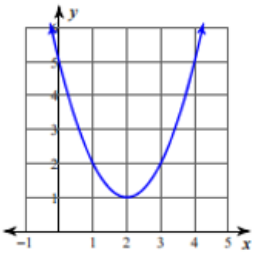
Find the domain and range and intervals of increasing and decreasing.



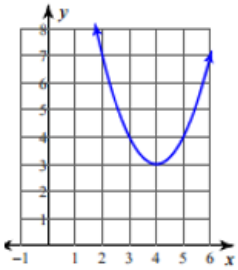
D = $(-\infty,\infty)$
R = $(-\infty,-3]$
Inc = $(-\infty,-2)$
Dec = $(-2,\infty)$



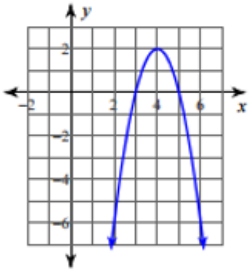
D = $(-\infty,\infty)$
R = $[0,\infty)$
Inc = $(0,\infty)$
Dec = $(-\infty,0)$



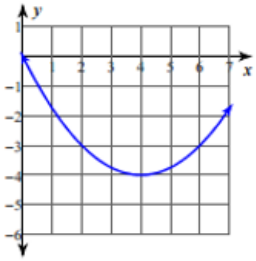
D= $(-\infty,\infty)$
R = $[1,\infty)$
Inc = $(2,\infty)$
Dec = $(-\infty,2)$



D = $(-\infty,\infty)$
R = $[3,\infty)$
Inc = $(4,\infty)$
Dec = $(-\infty,4)$



D = $(-\infty,\infty)$
R = $(-\infty,2]$
Inc = $(-\infty,4)$
Dec = $(4,\infty)$



D = $(-\infty,\infty)$
R = $[-4,\infty)$
Inc = $(4,\infty)$
Dec = $(-\infty,4)$

GSE Algebra II Unit 1A – Quadratics Revisited 1A.3 Notes

Operations of Complex Numbers

Definition of i $\sqrt{-1}$

$i^5 = i^4 \cdot i = 1 \cdot i = i$
$i^6 = i^4 \cdot i^2 = 1 \cdot -1 = -1$

$i \cdot i^2$
$i^3 \cdot i^2$

i	$\sqrt{-1}$	i
i^2	$\sqrt{-1}\cdot\sqrt{-1}$	-1
i^3	$i \cdot -1$	-i
i^4	$-1 \cdot -1$	1

How do we remember the pattern? i -1 -i 1

Complex Numbers $a + bi$ (standard form)
real imag. part

$\frac{5+7i}{2} = \frac{5}{2} + \frac{7i}{2} = \frac{5}{2} + \frac{7}{2}i$

Example: $5(3+2i) - 2i(1-3i)$
$15 + 10i - 2i + 6i^2$
$15 + 10i - 2i - 6$
$9 + 8i$

What can you do with complex numbers?

+	−	·	÷

How do we divide complex numbers? Goal: Get rid of the i in the denominator!

1. Add: $(2 - 4i) + (4 + 3i)$
$2 - 4i$
$4 + 3i$
$\boxed{6 - i}$

2. Subtract: $(-3 + i) - (-8 + 2i)$
$-3 + i$
$8 - 2i$
$5 - i$

3. Multiply: $(3 - 2i)(5 + i)$
$15 + 3i$
$-10i$
$+2$
$-2i^2$
$\boxed{17 - 7i}$

4. Multiply: $(2 + 3i)^2$
$(2+3i)(2+3i)$
$4 + 6i$
$6i - 9$
$+9i^2$
$-5 + 12i$

5. Divide: $\frac{3i}{5-2i}$ $(5+2i)$ $(5+2i)$
$\frac{15i + 6i^2}{25 + 10i - 10i - 4i^2}$ $+4$ $= \frac{-6 + 15i}{29}$
$\frac{-6}{29} + \frac{15}{29}i$

Yes... Write this down in a notebook.

What is a conjugate?

Binomials that have the SAME terms but OPPOSITE operation signs.

$1+\sqrt{2}$ $\quad$ $1-\sqrt{2}$

$-4x+2$ + $-4x-2$ are conjugates

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

What is a special property of conjugates?

$(2x+3)(2x-3)$

$4x^2-6x+6x-9=4x^2-9$

D.O.S $(a+b)(a-b)=a^2-b^2$

Find the complex conjugate and multiply.

$(2+5i)(2-5i)$

$4-\cancel{10i}+\cancel{10i}-25i^2$

$4+25=29$

$(a+bi)(a-bi)$

$=a^2+b^2$

How do you simplify rational complex numbers?

Case 1: $\frac{7}{2i}$

Monomial in the denominator- Multiple numerator and denominator by $\underline{\ i\ }$.

$$\frac{7}{2i}\cdot\frac{i}{i}=\frac{7i}{2i^2}=\frac{7i}{-2}=-\frac{7i}{2} \text{ OR } \frac{-7i}{2}$$

Case 2: $\frac{2}{1-3i}$

Binomial in the denominator - Multiply numerator and denominator by the <u>complex conjugate</u>

$$\frac{2}{1-3i}\cdot\frac{(1+3i)}{(1+3i)}=\frac{2+6i}{1+3i-3i-9i^2}=\frac{2+6i}{10}$$

$$\frac{2}{10}+\frac{6}{10}i$$

$$\frac{1}{5}+\frac{3}{5}i$$

Board Work

Set A # 1 - 6

$(4i)-(-1+i)$

$4+(1-i)$

$(2-8i)-(i)$

$(3+8i)+(6+i)$

$(7-5i)+(-8-6i)$

$(1-6i)+(-3-6i)$

Board Work

Set B # 7 – 11

$(-4+5i)^2$

$(4+5i)(8+8i)$

$(-3-3i)(2-2i)$

$(3+2i)(5i)(3-2i)$

Challenge:
$(2+i)(3-i)(3+i)(5-i)$

Board Work

Set C # 12 - 15

$-\frac{9}{7i}$

$\frac{10}{1-2i}$

$\frac{3}{9+4i}$

$\frac{1-5i}{5-4i}$

We are starting with this!

1) monomial : $\cdot i$

2) binomial : $\cdot a+bi$

$i^2 = -1$

$$\frac{3-7i}{1+2i}\frac{(1-2i)}{(1-2i)} = \frac{3-6i-7i+14i^2}{5}$$

$$= \frac{-11}{5} - \frac{13}{5}i$$

$$\frac{1-i}{1+i}\frac{(1-i)}{(1-i)} = \frac{1-i-i+i^2}{1-i+i-i^2}$$

$$= \frac{1-2i-1}{1+1}$$

$$= \frac{-2i}{2} = -i$$

$$\frac{1-i}{2-i}\frac{(2+i)}{(2+i)} = \frac{2+1-2i-i}{4-\cancel{2i}+\cancel{2i}-i^2}$$

$$+1$$

$$\frac{3-i}{5}$$

$$\frac{3}{5}-\frac{1}{5}i$$

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

$$= \frac{-12i}{8} = \frac{-3i}{2} = -\frac{3}{2}i$$

$$\frac{2+2i}{3+3i}\frac{(3-3i)}{(3-3i)} = \frac{6-6i+6i-6i^2}{9-9i+9i-9i^2}$$

$$= \frac{12}{18} = \frac{2}{3}$$

$$\frac{4-3i}{5i}\cdot\frac{i}{i} = \frac{4i-3i^2}{5i^2}$$

$$= \frac{3+4i}{-5}$$

$$= -\frac{3}{5}-\frac{4}{5}i$$

Set D # 16 – 18

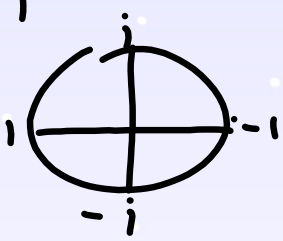
$i^{12}+i^{21}$

$5i(3+i)+3(1-i)$

$5i^5-12i^{100}+4i^{32}-9i^9+13i^7$

$$\begin{array}{r} 1\ R1 \\ 4\overline{)5} \\ \underline{4} \\ 1 \end{array}$$

$i^2=-1$



$i^1 = i^{21} = i$

i
$i^2 = -1$
$i^3 = -i$
$i^4 = 1$

$$\begin{array}{r} 5\ R1 \\ 4\overline{)21} \\ \underline{20} \\ 1 \end{array}$$