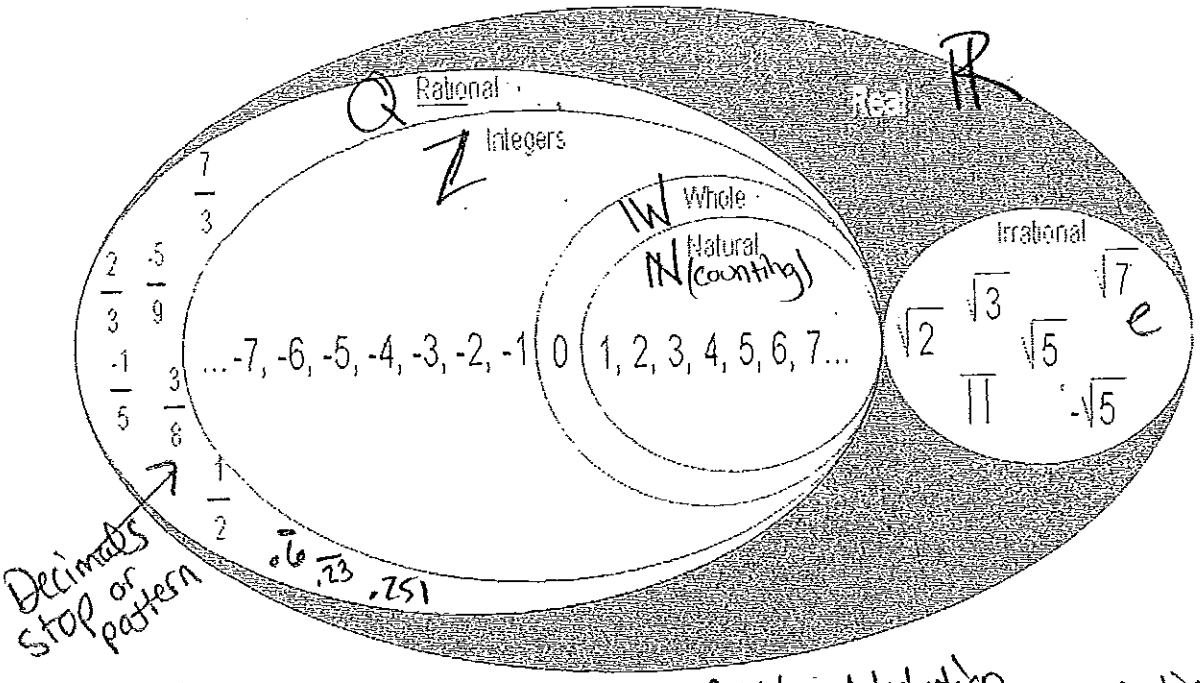
P.1 Real Numbers

Real Number System



Set Builder Notation

Rational

$\left\{ \frac{a}{b} \mid a, b \text{ integers} \And b \neq 0 \right\}$

Recall: Terminating vs. Repeating

↑ Rational

Sheet Protectors

- Trichotomy Property –

2 #s $a \And b$

① $a < b$, ② $a = b$, or ③ $a > b$ } only one can be true

← such that

- Inequalities can be used to describe INTERVALS of real numbers

$x \leq 2$ $(-\infty, 2]$

$-2 \leq x+1 < 5$

$-1 \quad -1 \quad -1$

$-3 \leq x < 4$

$[-3, 4)$

$<$ ( ) ○

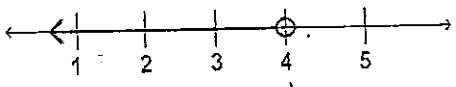
$>$ ( ) ○

$\leq$ [ ] ●

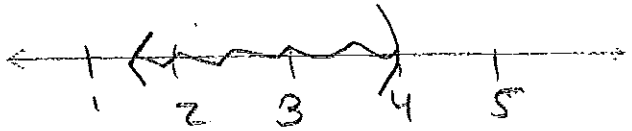
$\geq$ [ ] ●

Example

Inequality

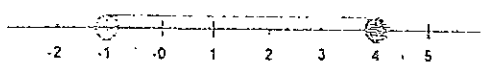


$x < 4$

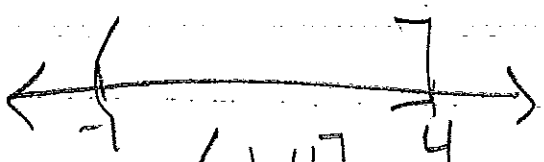


$(-\infty, 4)$

Double Inequality $-1 < x \leq 4$



Interval



$(-1, 4]$

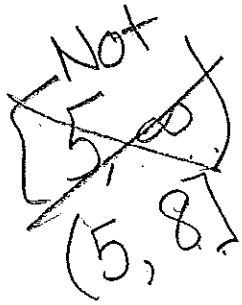
➢ Bounded Intervals – finite length, has endpoints (No ∞ or $-\infty$)

Closed $[a, b]$ $a \leq x \leq b$

Open (a, b) $a < x < b$

Half-Open $[a, b)$ $(a, b]$ $a \leq x < b$

Not



Ex

$[3, 5]$ B H O

$(6, 7)$ B O

$(-\infty, 5]$ U C

$[3, \infty)$ U C

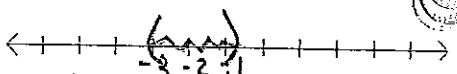
$(7, \infty)$ U O

➢ Unbounded Intervals – interval without finite length (will have ∞, or $-\infty$)

Closed $[a, \infty)$ $x \geq a$ $(-\infty, a]$ $x \leq a$

Open (a, ∞) $x > a$ $(-\infty, a)$ $x < a$

Example

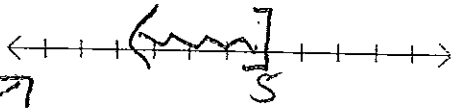


Write the interval of real numbers using an inequality and draw the graph

a) The real numbers between -3 and -1

Ineq. $-3 < x < -1$ Interval $(-3, -1)$

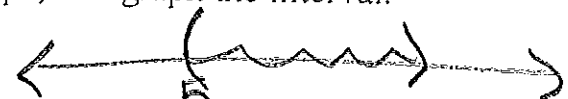
b) The real numbers less than or equal to 5



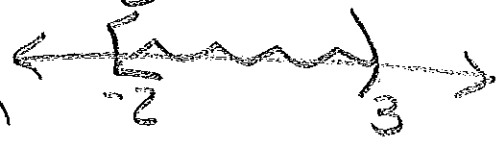
Example Ineq. $x \leq 5$ Int. $(-\infty, 5]$

Convert interval notation to inequality notation or vice versa. Find the endpoints and state whether the interval is bounded, its type, and graph the interval.

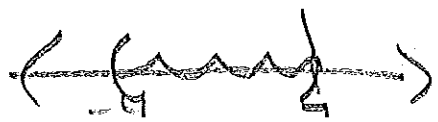
a) $(5, \infty)$ $5 < x < \infty$ $5 < x$ unbounded, open



b) $[-2, 3)$ $-2 \leq x < 3$ bounded, half-open



c) $-4 < x < 7$ $(-4, 7)$



P.1 – Day 2

Letter or symbol # replaces

Variables, #s, operations

-c c
b -b
a -a

➢ Review Terms – constant, algebraic expression, additive inverse/opposite, multiplicative inverse/reciprocal.

a 1/a

➢ Properties:

		Add.	Mult.
order "Social"	Commutative	$a+b=b+a$	$ab=ba$
	Associative	$(a+b)+c=a+(b+c)$	$(ab)c=a(bc)$
	Identity	$a+0=a$	$a\cdot 1=a$
	Inverse	$a+-a=0$	$a\cdot \frac{1}{a}=1$
	Distributive	$a(b+c)=ab+ac$	

Trans. Symm. Reflexive

Example

Write the expanded form of $(x+3y)x$ x^2+3xy

Write the factored form of $4z^2+20z$

$4z(z+5)$

4
2 2
z z

$4z^2: 2 \cdot 2 \cdot z \cdot z$
$20z: 2 \cdot 2 \cdot 5 \cdot z$

20
2 10
2 5

➢ Exponential Notation

$x^3 = X \cdot X \cdot X$

Zero Exponent	$a^0 = 1$
Negative Exponent	$a^{-n} = \frac{1}{a^n}$ $x^{-4} = \frac{1}{x^4}$
Product of Powers	$a^m \cdot a^n = a^{m+n}$
Quotient of Powers	$\frac{a^m}{a^n} = a^{m-n}$
Power of a Power	$(a^m)^n = a^{mn}$
Power of a Product	$(a \cdot b)^m = a^m b^m$
Power of a Quotient	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

Example

Simplify

(1) $\frac{u^2v^{-3}}{u^{-1}v^2}$

$u^3 v^{-5}$

$\frac{u^3}{v^5}$

(2) $\left(\frac{x}{3}\right)^{-4}$

$\frac{x^{-4}}{3^{-4}}$ $\frac{3^4}{x^4}$

$\frac{81}{x^4}$

(3) $\frac{x^7y^3}{x^4y^9}$

x^3y^{-6}

$\frac{x^3}{y^6}$

- **Scientific Notation**

$a \times 10^n$

$1 \leq a < 10$

$.64 \times 10^5$ Not

Example

Convert .0000345 to scientific notation.

3.45×10^{-5}

Convert 1.23×10^5 from scientific notation.

1.23 → 123,000

Simplify $\frac{(1.3\times10^7)(2.5\times10^{-3})}{2.5\times10^4}$ without a calculator.

$\frac{(1.3)(2.5)}{(2.5)} \times 10^{7+-3-4}$

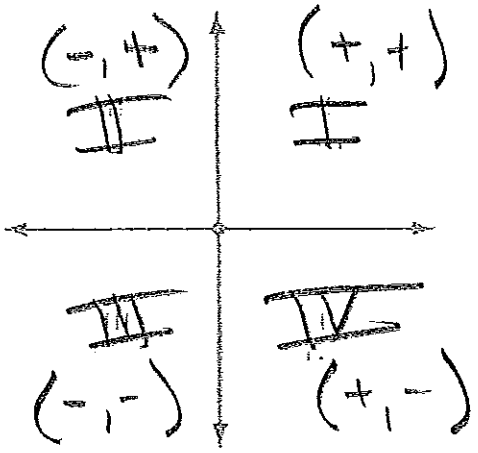
1.3×10^0

$1.3 \times 1 = 1.3$

P.2 Cartesian Coordinate System

Recall:

- Scatter Plots – (x, y)



- Properties of Absolute Value -

$|a| \geq 0$

$|ab| = |a| \cdot |b|$ $\quad$ $\frac{|a|}{|b|} = \left|\frac{a}{b}\right|$

- Distance Formula –

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$ Based on Pyth.

Example

Find the distance between (2, 4) and (7, 13).

$x_1\ y_1 \quad x_2\ y_2$

$$\sqrt{(7-2)^2 + (13-4)^2}$$

$$\sqrt{25+81} = \sqrt{106} = 10.296$$

Ex $5+11$, $5-11$

- Midpoint Formula

$$\left(\frac{x+x}{2}, \frac{y+y}{2}\right)$$

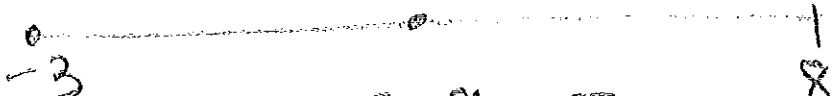
$(2, 3)$ $(-5, 7)$

$\frac{2-5}{2}, \frac{3+7}{2}$

$(-1.5, 5)$

Example

Find the midpoint of the line segment with endpoints -3 and 8.



$-3+8$ $\quad$ 5 $\quad$ (2.5)

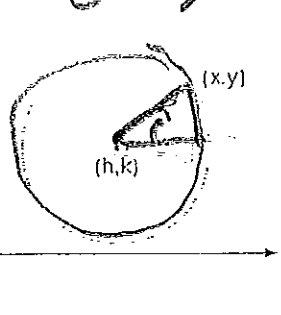
Find the midpoint of a line segment with endpoints (3, 6) and (-2, 7).

$$\left(\frac{3+-2}{2}, \frac{6+7}{2}\right) = (.5, 6.5)$$

- Equations of Circles

$$(x-h)^2 + (y-k)^2 = r^2$$

center: (h, k) — radius: r



Examples

Find the standard form equation of the circle with a center of (-6, 8), radius 2.

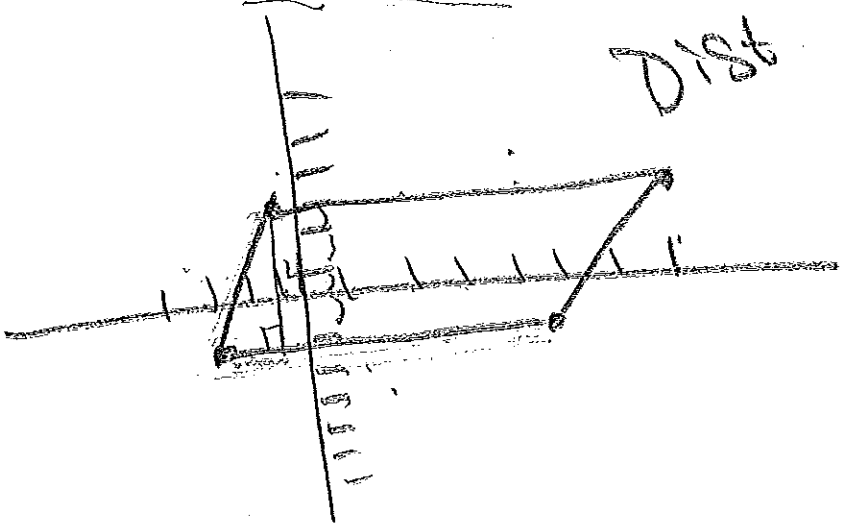
h k

$$(x--6)^2 + (y-8)^2 = 2^2$$

$$(x+6)^2 + (y-8)^2 = 4$$

$x^2 + (y-3)^2 = 49$
Center (0, 3)
Radius 7

Find the area and perimeter of the figure. (-3, -1) (-1, 3) (7, 3) (5, -1).



Dist

P = add all sides

$P = 16 + 4\sqrt{5} \approx 9.8$

Area = $8 \cdot 4 = 32 u^2$

b · h

P.3: Linear Equations and Inequalities

- Properties of Equality

  Reflexive $X = X$ "Reflection"

  Symmetric If $x = y$, then $y = x$

  Transitive/Syllogism $x = y$ and $y = z$ then $x = z$

  Addition $x = y$ $a + x = a + y$

  Multiplication $x = y$ $a \cdot x = a \cdot y$

- Linear Equations – Lines

  $y = mx + b$ Slope-Intercept

  $y - y_1 = m(x - x_1)$ Pt-Slope Form

  $Ax + By = C$ Standard Form

Example

State whether the following are linear or not and how you know.

$Y = 4x - 5$ Yes

$2x + 3y = 12$ Yes

$3x^2 + 4 = 24$ No x^2

$X = 7$ Yes ↕

$5^3 + x = y$ Yes

125

- Equivalent Equations – equations w/ same solution

  $2x = 12$

  $x = 6$

  $\frac{1}{2}x = 3$

  $y = 12$

  - Operations that result in equivalent equations:

    \+ −

    × ÷

    $3 - (x + 3) = 12$

Example

Solve $-3(x+2)+2(x-1) = -4x + 4$. Support your results with a calculator.

$-3x - 6 + 2x - 2 = -4x + 4$

$-1x - 8 = -4x + 4$

$-12 = -3x$

$x = 4$

Example

Solve $5(2x) - 2(4x - 3) = -x - 9$. Support your results with a calculator.

$10x - 8x + 6 = -x - 9$

$2x + 6 = -x - 9$

$3x = -15$

$x = -5$

Example

Solve $\frac{5y+2}{3} = 3 + \frac{y}{2}$

$\frac{3(5y+2)}{3} = 9 + \frac{3y}{2}$

$5y + 2 = 9 + 1.5y$

$y = 2$

$\left(\frac{5y+2}{3} = 3 + \frac{y}{2}\right)6$

$\frac{6(5y+2)}{3} = 18 + \frac{6y}{2}$

$2(5y+2) = 18 + 3y$

Solve $\frac{5x-1}{2} = 4 - \frac{x}{2}$

$\frac{2(5x-1)}{2} = 8 - \frac{2x}{2}$

$5x - 1 = 8 - x$

$6x = 9$

$x = 9/6$

$3/2$

$x = 1.5$

- Linear Inequality $5 < x + 2$
- Properties of Inequalities

$\frac{-5x}{-5} < \frac{20}{-5}$

$x > -4$

$\frac{5x}{5} < \frac{-20}{5}$

$x < -4$

Example

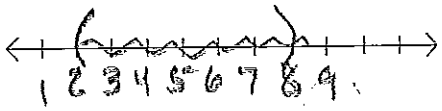
Solve the inequality $-3(2x-1)+2(x-1)<-3x+6$. Write your solution set in interval notation.

$$-6x+3+2x-2<-3x+6$$
$$-4x+1<-3x+6$$
$$-5<1x$$
$$x>-5$$
$$(-5,\infty)$$

Example

Solve the inequality $1<\frac{2x-1}{3}<5$ Write your solution set in interval notation and graph the solution set.

$$\left(1<\frac{2x-1}{3}<5\right)3$$

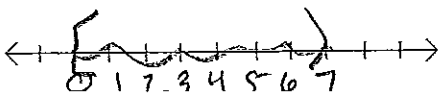


$$3<2x-1<15$$
$$+1 \quad +1 \quad +1$$
$$\frac{4}{2}<\frac{2x}{2}<\frac{16}{2}$$
$$2<x<8 \qquad (2,8)$$

Example

Solve the inequality $-1\leq\frac{4x-7}{7}<3$ Write your solution set in interval notation and graph the solution set.

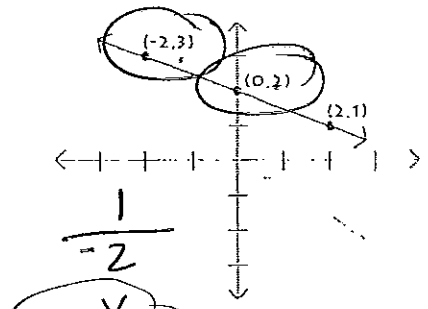
$$\left(-1\leq\frac{4x-7}{7}<3\right)7$$
$$-7\leq 4x-7<21$$
$$0\leq 4x<28$$
$$0\leq x<7$$
$$[0,7)$$



P.4 Lines in the Plane

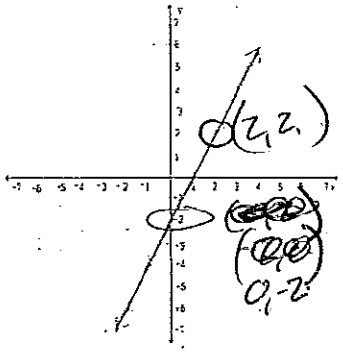
$\frac{y_2-y_1}{x_2-x_1}$ $\frac{\Delta y}{\Delta x}$

- Slope of a Line
  - Vertical Line ↕ undefined or no $\frac{5}{0}$
  - Horizontal Line ⟷ zero $\frac{0}{5}$



$\frac{1}{-2}$

$-\frac{1}{2}$



$\frac{-2-2}{0-2}$ $\frac{-4}{-2}$ (2)

- Slope-Intercept Form $y=mx+b$
- Point-Slope Form $y-y_1=m(x-x_1)$
- General Form (AKA Standard Form) $Ax+By=C$

$Ax+By+C=0$

Example

Use point-slope form to find an equation for the line that passes through (-5, 2) and has a slope of -3. Your final answer should be in slope-intercept form.

x y

$y-2=-3(x+5)$

$y-2=-3x-15$

$y=-3x-13$

Example

Use point-slope form to find an equation for the line that passes through (1, 3) and (-4, 9). Your final answer should be in slope-intercept form.

Slope $\frac{y-y}{x-x}$

$\frac{9-3}{-4-1}=\frac{6}{-5}$

$y-3=-\frac{6}{5}(x-1)$

$y-3=-\frac{6}{5}x+\frac{6}{5}$ $1\frac{1}{5}$

$+3$ $+3$

Example

Write an equation of the line with a slope of 2 that passes through the point (-4, 7) using the slope-intercept form.

x y

$y-7=2(x+4)$

$y-7=2x+8$

$y=2x+15$

$y=mx+b$

$y=2x+b$

$7=-8+b$

$b=15$

$y=2x+15$

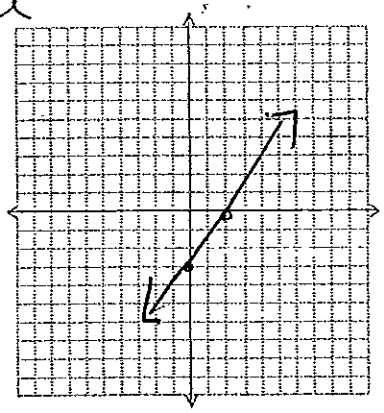
Examples

a. Draw the graph of $3x - 2y=6$. (0, -3) (2, 0)

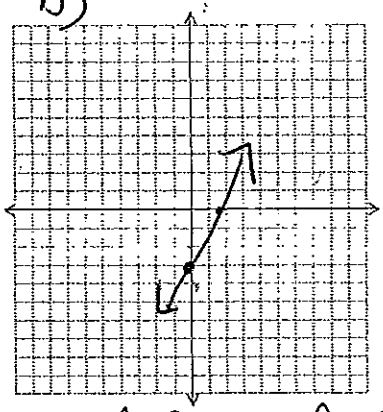
b. Draw the graph of $2x-y = 3$ (0, -3) (1.5, 0) $-y=-2x+3$, $y=2x-3$

c. Draw the graph of $-2x + 2y = 4$ (0, 2) (-2, 0)

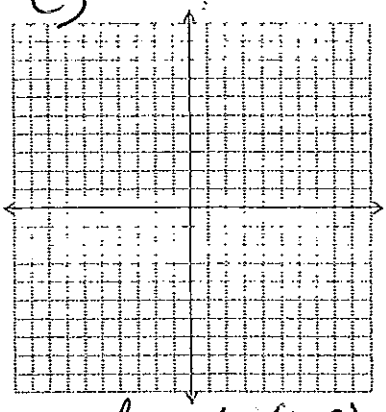
a



b)



c)



Ex Find x for a line with slope of 2 & through (x, 3) and (5, 9).

$\frac{9-3}{5-x}=2$ $6=2(5-x)$ $6=10-2x$ (2)

P.4 Day 2

- Parallel Lines || Same slope, diff y-int.
- Perpendicular Lines ⊥ opp. reciprocals

$7 \rightarrow -1/7$ $\frac{0}{2} \rightarrow$ undef. $\frac{2}{0}$

$2/3 \rightarrow -3/2$

Example

Find the equation of the line through P(2, -1) that is parallel to the line L with equation $3x + 2y = 5$.

same

$\frac{2y}{2} = \frac{-3x+5}{2}$

$y = -\frac{3}{2}x + \frac{5}{2}$

$y + 1 = -\frac{3}{2}(x-2)$

$y + 1 = -\frac{3}{2}x + 3$

$y = -\frac{3}{2}x + 2$

Example

Find an equation for the line passing through the point and parallel to the given line. P(-2, -2); $3x - 2y = 4$

Slope $\frac{3}{2}$

$y + 2 = \frac{3}{2}(x+2)$

$y + 2 = \frac{3}{2}x + 3$

$y = \frac{3}{2}x + 1$

Example

Find an equation of the line through P(2, 1) that is perpendicular to the line L with equation $-x + 2y = -3$. Support the result with a grapher.

$-x + 2y = -3$

$\frac{2y}{2} = \frac{1x - 3}{2}$

$y = \frac{1}{2}x - \frac{3}{2}$

Slope $= -2$

$y - 1 = -2(x-2)$

$y - 1 = -2x + 4$

$y = -2x + 5$

Example

Find an equation of the line through P(2,1) that is perpendicular to the line L with equation $3x - y = 3$. Support the result with a grapher.

Slope 3

$m = -\frac{1}{3}$

$y - 1 = -\frac{1}{3}(x-2)$

$y - 1 = -\frac{1}{3}x + \frac{2}{3}$

$y = -\frac{1}{3}x + \frac{5}{3}$

Applying to Real-Life

American's disposable income in trillions of dollars is given in the table.

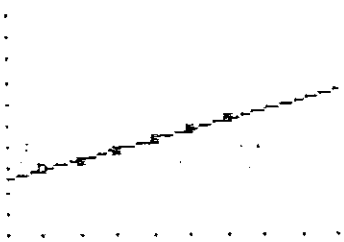
Year	Amount (trillions of dollars)
2002	8
2003	8.4
2004	8.9
2005	9.3
2006	9.9
2007	10.4

(a) Write a linear equation for Americans' disposable income y in terms of the year x using the points (2002,8) and (2004,8.9). $y = .45x - 897.9$

(b) Use the equation in (a) to estimate Americans' disposable income in 2005. 9.35 trill

(c) Use the equation in (a) to predict Americans' disposable income in 2010. 11.6 trill

(d) Superimpose a graph of the linear equation in (a) on a scatter plot of the data.



P.5 Solving Equations Graphically, Numerically, and Algebraically

What ways can we solve the equation: $x^2 - x - 6 = 0$? Quad.

1. Graph ← 2nd Calc Zero
2. Quad ← $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $a=1$ $b=-1$ $c=-6$
3. Table
4. Complete the Square
5. Factoring

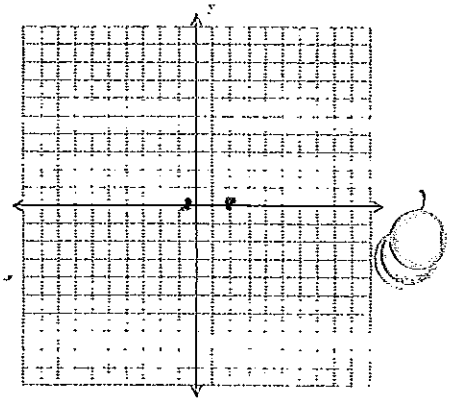
$y=0$

x-intercepts

$(x-3)(x+2)=0$

$x-3=0$ or $x+2=0$

3 $\quad -2$



Example - Graphically

Solve the equation $2x^2 - 3x - 2 = 0$ graphically.

$-\frac{1}{2}$ & 2

Example – Algebraic

Solve the equation algebraically $\sqrt{(2x-1)^2} = \sqrt{16}$

$(2x-1)(2x-1)$

$4x^2 - 4x + 1 = 16$

Quad $4x^2 - 4x - 15 = 0$ 2.5 & -1.5

$2x-1=4$ or $2x-1=-4$

$+1 \quad +1$

$x = 5/2$ (2.5) $\quad 2x = -3$ $x = -1.5$

Example – Graphically

Solve the equation graphically $x^3 + 2x - 1 = 0$

(.453, 0)

Example – Tables

Solve the equation $x^3 + 2x - 1 = 0$ using grapher tables.

(.453, 0) 2nd Table Set

Try It– Tables

Solve the equation $x^3 + 4x - 2 = 0$ using grapher tables.

.5

P.5 Day 2

Example – Algebraic (quadratic formula)

$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ ← discriminant

Solve the equation $2x^2 + 3x - 5 = 0$.

$a = 2 \quad b = 3 \quad c = -5$

$$\frac{-3 \pm \sqrt{3^2 - 4 \cdot 2 \cdot -5}}{2 \cdot 2}$$

$$= \frac{-3 \pm \sqrt{49}}{4} = \frac{-3 \pm 7}{4}$$

1, -2.5

Try It – Algebraic

Solve the equation by using the quadratic formula $4x^2 - 6x = 3$

$a = 4$
$b = -6$
$c = -3$

$$\frac{6 \pm \sqrt{(-6)^2 - 4 \cdot 4 \cdot -3}}{2 \cdot 4}$$

$$\frac{6 \pm \sqrt{84}}{8}$$

1.89 & -.395

① $x^2+6x+9=90$

② $x^2-8x+16=16$

③ $x^2+20x+100=13$

④ $x^2-1x-6=10$

⑤ $x^2-2x-8=15$

Where we are gang:

$x^2+3x+y^2-2y=15$

➢ RECALL: Completing the Square

$$x^2 + bx + (b/2)^2 = c + (b/2)^2$$

$$\left(x+\frac{b}{2}\right)^2 = c + \left(\frac{b}{2}\right)^2$$

Example – Algebraic (completing the square)

Solve $x^2 + 6x = 7$ by completing the square.

$\left(\frac{6}{2}\right)^2$

$x^2+6x+9 = 7+9$

$\sqrt{(x+3)^2} = \sqrt{16}$

pos & neg

$x+3=4$ or $x+3=-4$

$-3\ -3$ $\quad -3\ -3$

$x=1$ $\quad x=-7$

EX $\left(\frac{4}{2}\right)^2$

$x^2+4x+4=12+4$

$x^2+4x+4=16$

$\sqrt{(x+2)^2}=\sqrt{16}$

$x+2=4$ or $x+2=-4$

$x=2$ or $x=-6$

Khan Academy

Try It

Solve $2x^2 - 7x + 9 = (x-3)(x-1) + 3x$ by completing the square.

$2x^2-7x+9 = x^2-x-3x+3+3x$

$-x^2 \quad -x^2$

$x^2-7x+9=-x+3$

$+x \quad +x$

$x^2-6x+9=3$

$-3 \quad -3$

$x^2-6x+6=0$

$+3 \quad +3$

$x^2-6x+9=3$

$\left(\frac{-6}{2}\right)^2$ c want to be 9

$x^2-6x+9=3$

$\sqrt{(x-3)^2}=\sqrt{3}$

$x-3=\pm\sqrt{3}$

$+3 \quad +3$

$x=\sqrt{3}+3$ or $-\sqrt{3}+3$

Example – Graphically

Solve the equation $-2|x-2| = -3$ graphically. Then verify your answer algebraically.

Y_1 Y_2

2nd Calc Int.

(Y_2, -3)

(3.5, -3)

$-2|x-2| = -3$

-2 -2

$|x-2| = 1.5$

$x-2 = 1.5$ or $x-2 = -1.5$

$+2$ $+2$ $+2$ $+2$

$x = 3.5$ $x = .5$

Try It

Solve the equation $|x-5| = -9$ graphically. Then verify your answer algebraically.

No Sol.

$\emptyset$ = Null Set

P.6 Complex Numbers

A **complex number** is any number that can be written in the form

$a + bi$,

where a and b are real numbers. The real number a is the **real part**, the real number b is the **imaginary part**, and $a + bi$ is the **standard form**.

- Recall: when you add or subtract complex numbers you add or subtract their real and imaginary parts separately!

Example

$(6-5i) + (-3 - 7i)$ $3-12i$

Try It

Write the sum or difference in standard form.

a) $(1 - 7i) + (12 + 32i)$ $13+25i$
b) $(18 - 3i) - (1 - 9i)$ $17+6i$
c) $(4 + 30i) + (-11 - 29i)$ $-7+i$

- Additive Identity $0+0i$
- Additive Inverse $-(a+bi)$ $-a-bi$

Example

Find $(3+2i)(4-i)$. FOIL

$12-3i+8i-2i^2$ (-1)

$14+5i$

Example

If $z = \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i$, find z^2 and z^3

$$z^2 = \left(\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i\right)\left(\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i\right)$$

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

$$-\frac{2}{4}$$

$$z^2 = i$$

$$z^3 = i\left(\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i\right)$$

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

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

- Multiplicative Identity $1 = 1 + 0i$
- Multiplicative Inverse $\frac{1}{a+bi}$

Examples

Write the complex number in standard form. mult by complex conj.

3. $\frac{3}{(2+i)} \cdot \frac{(2-i)}{(2-i)}$

$$\frac{6-3i}{4-i^2} \quad (-1)$$

$$\frac{6-3i}{5}$$

$$\frac{6}{5} - \frac{3}{5}i$$

$$\frac{3+3i}{2-i} \cdot \frac{2+i}{2+i}$$

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

$$\frac{6+9i+3i^2}{4-i^2} \quad (i^2 = -1)$$

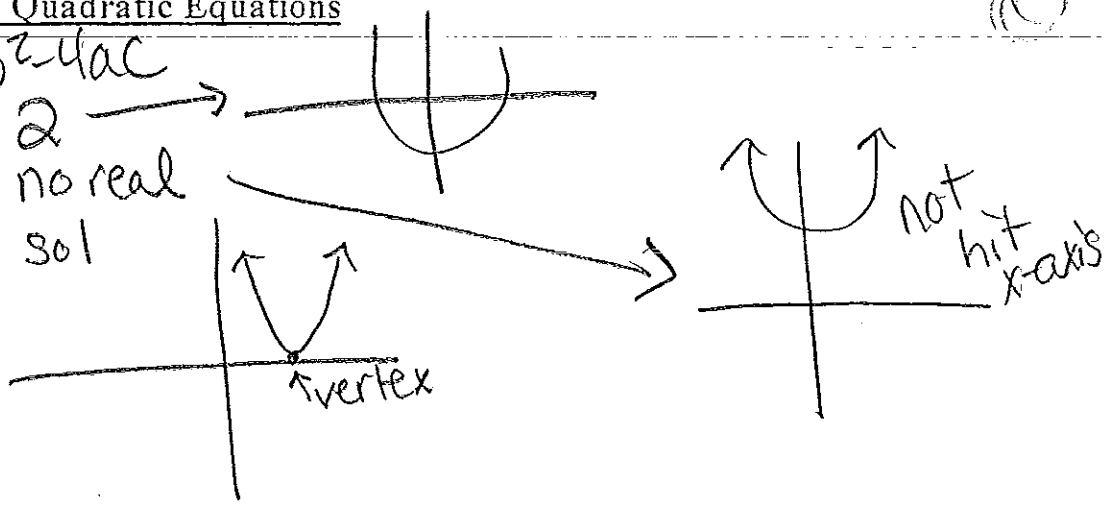
$$\frac{3+9i}{5}$$

$$3/5 + 9/5\,i$$

EX $\frac{4+i}{2i} \cdot \frac{-2i}{-2i}$

Complex Solutions of Quadratic Equations

- Discriminant b^2-4ac
  - Positive → 2
  - Negative → no real
  - Zero → 1 sol



Example

Solve $2x^2 + 2x + 1 = 0$

$A=2$
$B=2$
$C=1$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

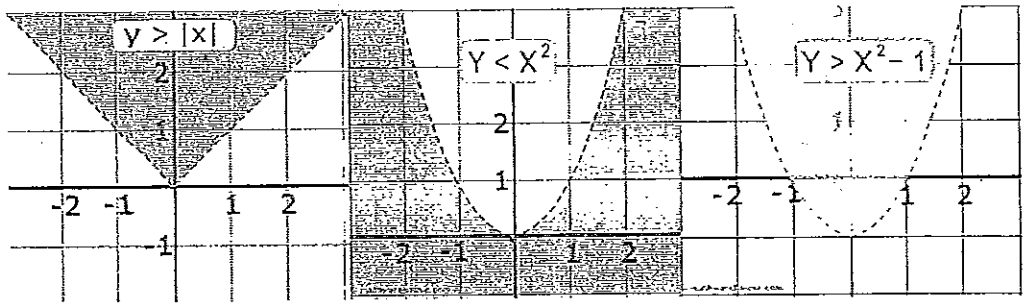
$$= \frac{-2 \pm \sqrt{2^2-4\cdot 2\cdot 1}}{2\cdot 2}$$

$$= \frac{-2 \pm \sqrt{-4}}{4}$$

$$\frac{-2 \pm \sqrt{4}\,i}{4}$$

$$\frac{-2 \pm 2}{4}\,i$$

P.7 Solving Inequalities Algebraically and Graphically



Examples - Absolute Value Inequalities

Solve the absolute value inequality $|2x+1|>4$. Write your answer in interval notation.

$2x+1>4$ or $2x+1<-4$

$x>3/2$ or $x<-5/2$

$(-\infty,-5/2)\cup(3/2,\infty)$

and ∩
or ∪

➢ Union –

Ex $x\neq 0$ $(-\infty,0)\cup(0,\infty)$

Solve the absolute value inequality $|3x+1|\geq 2$. Write your answer in interval notation.

$3x+1\geq 2$ $3x+1\leq -2$

$x\geq 1/3$ $x\leq -1$

$(-\infty,-1]\cup[1/3,\infty)$

Examples – Quadratic Inequalities

Solve $x^2-x-6\geq 0$ algebraically.

$(x-3)(x+2)=0$

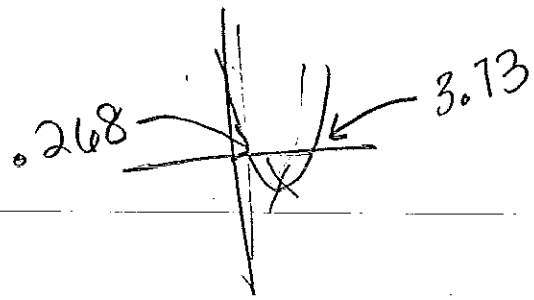
$x-3=0$ or $x+2=0$

$x\geq 3$ $x\leq -2$

$(-\infty,-2]\cup[3,\infty)$

Solve ~~X~~ algebraically. $x^2-4x-12\leq 0$

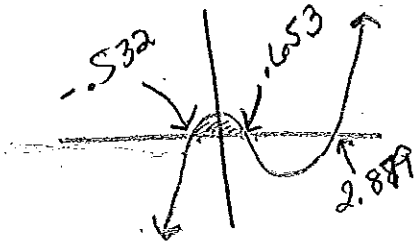
Solve $x^2 - 4x + 1 \geq 0$ graphically.



$(-\infty, .268] \cup [3.73, \infty)$

Examples – Cubic Inequalities

Solve $x^3 - 3x^2 + 1 \geq 0$ graphically.



$[-.532, .653] \cup [2.879, \infty)$

- Solve $-x^3 + x^2 + x \geq 0$ graphically.

$-.618, 0, 1.618$

$(-\infty, -.618] \cup [0, 1.618]$

- Projectile Motion

Suppose an object is launched vertically from a point s_0 feet above the ground with an initial velocity of v_0 feet per second. The vertical position s (in feet) of the object t seconds after it is launched is

$$s = -16t^2 + v_0t + s_0.$$

$S = -16t^2 + 288t + S_0$

S_0

A projectile is launched straight up from ground level with an initial velocity of 288ft/sec.

(a) When will the projectile's height above ground be 1152 ft?

(b) When will the projectile's height above ground be at least 1152 ft?

$1152 = -16t^2 + 288t$

$-16t^2 + 288t - 1152 = 0$

$t^2 - 18t + 72 = 0$

$(t-12)(t-6) = 0$

6 & 12

$6 \leq x \leq 12$

6-12 sec