College Algebra — Joysheet 9
MAT 140, Spring 2016 — D. Ivanšić

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Covers: 3.3, 3.4, 3.5 Show all your work!

1. (4pts) Solve the equation.

$|3x-1|=10$

$3x-1=10$ or $3x-1=-10$

$3x=11$ $\quad$ $3x=-9$

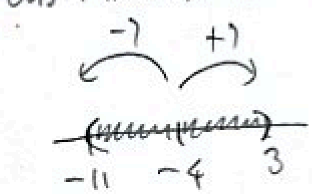
$x=\frac{11}{3}$ or $x=-3$

2. (12pts) Solve the inequalities. Draw your solution and write it in interval form.

$|x+4|<7$

$|x-(-4)|<7$

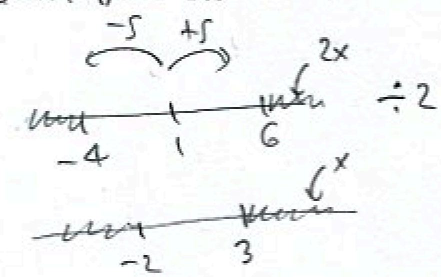
dist. from x to -4 <7



$(-11,3)$

$|2x-1|\ge 5$

dist. from $2x$ to 1 ≥ 5



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

Solve the equations:

3. (8pts) $\dfrac{x}{x-3}-\dfrac{3}{x+1}=\dfrac{4x+16}{x^2-2x-3}$ $\Big|\cdot(x-3)(x+1)$

$(x-3)(x+1)$

$x(x+1)-3(x-3)=4x+16$

$x^2+x-3x+9=4x+16$

$x^2-6x-7=0$

$(x-7)(x+1)=0$

$x=7,-1$

-1 gives 0 in denom so not a sol.

Only sol is $x=7$

4. (8pts) $x=4+\sqrt{40-6x}$

$x-4=\sqrt{40-6x}$ $\Big|^2$

$x^2-8x+16=40-6x$ $\Big|+6x-40$

$x^2-2x-24=0$

$(x-6)(x+4)=0$

$x=6$ or -4

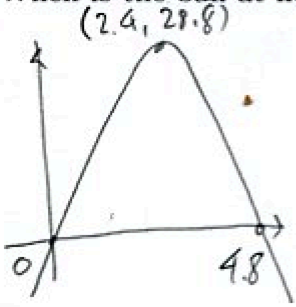
check: $x=6$ $\quad 6\overset{?}{=}4+\sqrt{40-36}$

$6\overset{?}{=}4+2$ yes

$x=-4$ $\quad -4\overset{?}{=}4+\sqrt{40+24}$

$-4\overset{?}{=}4+8$ no

5. (14pts) A ball is thrown upwards from the ground with initial velocity 24 meters per second. Its height in meters after t seconds is given by $s(t) = -5t^2 + 24t$.
a) Sketch the graph of the height function.
b) When does the ball reach its greatest height, and what is that height?
c) When is the ball at height 21 meters?

a) 

$-5t^2+24t=0$

$t(-5t+24)=0$

$t=0,\ \frac{24}{5}=4.8$

b) need vertex

$h=-\frac{b}{2a}=-\frac{24}{2(-5)}=2.4$ seconds

$k=s(2.4)=-5\cdot 2.4^2+24\cdot 2.4=28.8$ meters

Reaches greatest height of 28.8m after 2.4 seconds

c) $-5t^2+24t=21$

$5t^2-24t+21=0$

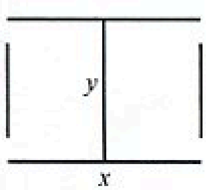
$t=\frac{-(-24)\pm\sqrt{(-24)^2-4\cdot 5\cdot 21}}{2\cdot 5}$

$=\frac{24\pm\sqrt{576-420}}{10}=\frac{24\pm\sqrt{156}}{10}$ 4.39

$=\frac{24\pm 2\sqrt{39}}{10}=\frac{12\pm\sqrt{39}}{5}\approx 3.649,\ 1.151$

It is at height 21 after 1.151 and 3.649 seconds

6. (14pts) A company is building a warehouse divided into two parts with four doors, so the walls with the doors have length 2/3 the length of that side of the building (see picture). They have budgeted for 9000 feet of walls, and their goal is to maximize the enclosed area.
a) Express the area of the warehouse as a function of one of the sides of the rectangle. What is the domain of this function?
c) Sketch the graph of the area function in order to find the maximum (no need for the graphing calculator — you should already know what the graph looks like). What are the dimensions of the warehouse that has the greatest area and what is the greatest area possible?



2/3 of length of side $=\frac{2}{3}y$

a) $9000=2x+y+\frac{2}{3}y\cdot 2$

$9000=2x+\frac{7}{3}y$

$2x=9000-\frac{7}{3}y$

$x=4500-\frac{7}{6}y$

$A=xy=(4500-\frac{7}{6}y)y$

$=-\frac{7}{6}y^2+4500y$

Domain:

Must have $y\geq 0$

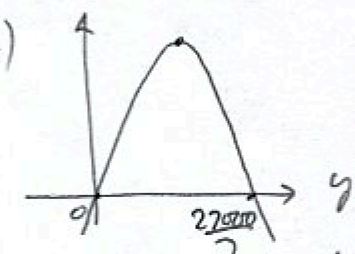
$x\geq 0$

$4500-\frac{7}{6}y\geq 0$

$\frac{7}{6}y\leq 4500$

$y\leq\frac{6\cdot 4500}{7}=\frac{27000}{7}$

$0\leq y\leq\frac{27000}{7}$

b) 

Vertex: $h=-\frac{b}{2a}=-\frac{4500}{2\cdot(-\frac{7}{6})}$

$=\frac{13500}{7}=1928.571429$

$k=\left(4500-\frac{7}{6}\cdot\frac{13500}{7}\right)\cdot\frac{13500}{7}$

$=2250\cdot\frac{13500}{7}=\frac{30{,}375{,}000}{7}$

$=4339{,}285.714$

Warehouse with biggest area is $2250\times\frac{27000}{7}$ $\left[\begin{matrix}1928.\\571429\end{matrix}\right]$ with area $\frac{30{,}375{,}000}{7}\approx 4{,}339{,}285.714$