**College Algebra — Joysheet 9**
**MAT 140, Spring 2023 — D. Ivanšić**

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

**1.** (4pts) Solve the equation.

$|2x+3|=1$

$2x+3=1$ or $2x+3=-1$

$2x=-2$ $\quad 2x=-4$

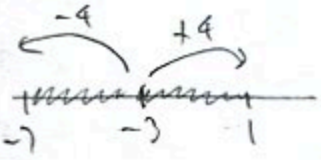
$x=-1$ or $x=-2$

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

$|x+3|<4$

$|x-(-3)|<4$

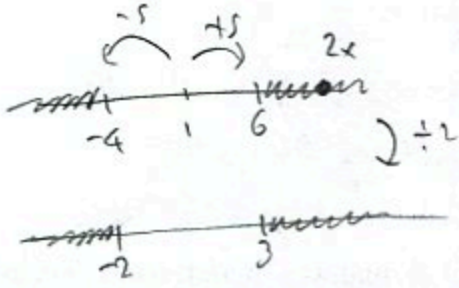
dist. From $x$ to $-3$ $<4$




$(-7,1)$

$|2x-1|>5$

dist. from $2x$ to $1$ $>5$




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

Solve the equations:

**3.** (8pts) $\dfrac{x-7}{x+2}+\dfrac{x+5}{x-2}=\dfrac{x^2-8x+40}{x^2-4}$ $\quad (x-2)(x+2)$

$\dfrac{x-7}{x+2}(x-2)(x+2)+\dfrac{x+5}{x-2}(x-2)(x+2)=\dfrac{x^2-8x+40}{(x-2)(x+2)}(x-2)(x+2)$

$(x-7)(x-2)+(x+5)(x+2)=x^2-8x+40$

$x^2-9x+14+x^2+7x+10=x^2-8x+40$

$2x^2-2x+24=x^2-8x+40 \quad | -x^2+8x-40$

$x^2+6x-16=0$ $\quad$ 4.47

$(x+8)(x-2)=0$

$x=-8, \cancel{2}$ 2 gives 0 in denominator so is not a solution

**4.** (8pts) $2x-2=x+\sqrt{39-2x}$ $\quad | -x$

$x-2=\sqrt{39-2x} \quad |^2$

$x^2-2\cdot x\cdot 2+2^2=\sqrt{39-2x}^2$

$x^2-4x+4=39-2x \quad | +2x-39$

$x^2-2x-35=0$

$(x-7)(x+5)=0$

$x=7, \cancel{-5}$ $\quad$ x=7 is only solution

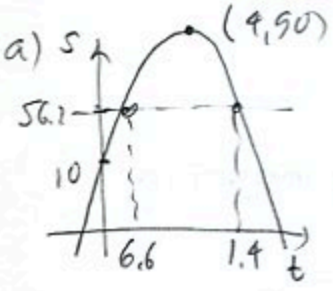
Check: $2\cdot 7-2=7+\sqrt{39-14}$

$12=7+\sqrt{25}$ yes

$2\cdot(-5)-2=-5+\sqrt{39-2(-5)}$

$-12=-5+\sqrt{49}$ no

**5.** (14pts) An arrow is launched from height 10 meters upwards with initial velocity 40 meters per second. Its height in meters after $t$ seconds is given by $s(t) = -5t^2 + 40t + 10$.
a) Sketch the graph of the height function.
b) When does the arrow reach its greatest height, and what is that height?
c) When is the arrow at height 56.2 meters?

a) 


b) $h = -\frac{b}{2a} = -\frac{40}{2\cdot(-5)} = 4$

$k = s(4) = -5\cdot 4^2 + 40\cdot 4 + 10 = 90$

max height of 90 meters is reached at time $t = 4$

c) $-5t^2 + 40t + 10 = 56.2$

$-5t^2 + 40t - 46.2 = 0$

$5t^2 - 40t + 46.2 = 0 \quad | \div 5$

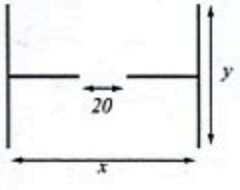
$t^2 - 8t + 9.24 = 0$

$t = \frac{-(-8) \pm \sqrt{(-8)^2 - 4\cdot 1\cdot 9.24}}{2} = \frac{8 \pm \sqrt{27.04}}{2}$

$= \frac{8 \pm 5.2}{2} = \frac{13.2}{2}, \frac{2.8}{2} = 6.6, 1.4$

Height 56.2 meters reached at times $t = 1.4$s (on way up) and $t = 6.6$s (on way down)

**6.** (14pts) A highway maintenance department is planning a building with two stalls intended to house its equipment. The stalls are connected by a 20ft wide door. The maintenance department has budgeted for total wall length 400 feet and its goal is to maximize the enclosed area.
a) Express the area of the building (the entire rectangle) 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 building that has the greatest area and what is the greatest area possible?




a) $A = x\cdot y = (420 - 2y)y = -2y^2 + 420y = A(y)$

$x - 20 + 2y = 400$

$x + 2y = 420$

$x = 420 - 2y$

Domain:

Must have: $y \geq 0$

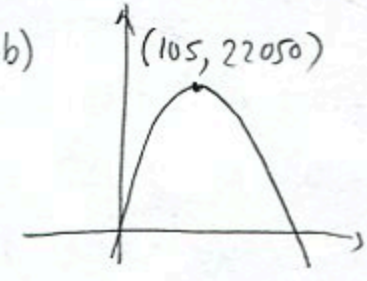
$x \geq 20$

$420 - 2y \geq 20$

$-2y \geq -400$

$y \leq 200$

Domain: $[0, 200]$

b) 


$h = -\frac{b}{2a} = -\frac{420}{2\cdot(-2)} = 105$

$k = -2\cdot 105^2 + 420\cdot 105 = 22{,}050$

Dimensions: $x = 420 - 2\cdot 105 = 210$

$y = 105$

Max area: 22,050