College Algebra — Joysheet 8
MAT 140, Fall 2012 — D. Ivanšić

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Show all your work!

1. (4pts) Solve the equation.

$|2x+4| = 15$

$2x+4=15$ or $2x+4=-15$

$2x=11$ $\quad$ $2x=-19$

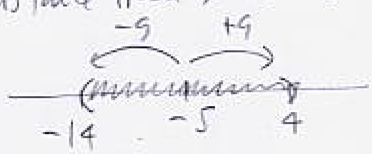
$x=\frac{11}{2}$ or $x=-\frac{19}{2}$

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

$|x+5| \le 9$

$|x-(-5)| \le 9$

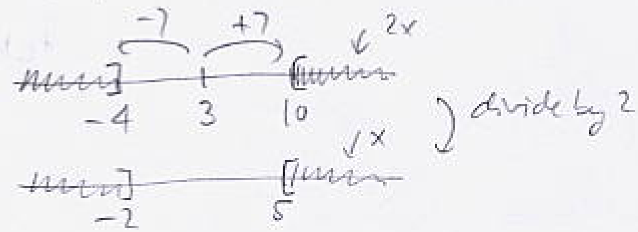
distance from x to $-5 \le 9$



$(-14, 4)$

$|2x-3| \ge 7$

distance from $2x$ to $3 \ge 7$



$(-\infty, -2] \cup [5, \infty)$

Solve the equations:

3. (8pts) $\dfrac{x}{x-1} - \dfrac{2x+30}{x^2+2x-3} = \dfrac{6}{x+3}$ $\quad \Big| \cdot (x-1)(x+3)$

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

$x(x+3) - (2x+30) = 6(x-1)$

$x^2+3x-2x-30 = 6x-6 \quad |-6x+6$

$x^2-5x-24=0$

$(x-8)(x+3)=0$

$x=-3$ or $\boxed{x=8}$

causes 0 in denom. in original equation - not a solution

solution

4. (8pts) $\sqrt{4x+5} + \sqrt{x+5} = 3$

$\sqrt{4x+5} = 3 - \sqrt{x+5} \quad |^2$

$4x+5 = 9 - 2\cdot 3\sqrt{x+5} + x+5 \quad |-x-14$

$3x-9 = -6\sqrt{x+5} \quad |\div 3$

$x-3 = -2\sqrt{x+5} \quad |^2$

$x^2-6x+9 = 4(x+5) \quad -4x-20$

$x^2-10x-11=0$

$(x-11)(x+1)=0 \quad x=11,-1$

check: $\sqrt{44+5}+\sqrt{16} \overset{?}{=} 3$ $\quad$ $\sqrt{-4+5}+\sqrt{-1+5} \overset{?}{=} 3$

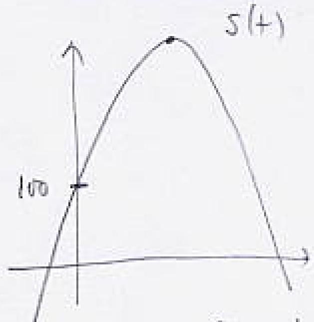
$7+4 \overset{?}{=} 3$ $\quad$ $\sqrt{1}+\sqrt{4} \overset{?}{=} 3$

no $\quad$ yes

$\boxed{x=-1}$ solution

5. (14pts) A model rocket is launched with initial velocity 80 ft/sec from a height of 100ft. The height of the rocket in feet t seconds after launch is given by $s(t) = -16t^2 + 80t + 100$.
a) When does the rocket reach its greatest height, and what is that height?
b) When does the rocket return to ground?

a)



max height for $t = -\frac{b}{2a} = -\frac{80}{2(-16)} = \frac{80}{32} = 2.5s$

Max height is $s(2.5) = -16 \cdot \frac{25}{4} + 80 \cdot \frac{5}{2} + 100$

$= -100 + 200 + 100 = 200$ ft

b) $s(t) = 0$

$-16t^2 + 80t + 100 = 0 \quad | \div (-4)$

$4t^2 - 20t - 25 = 0$

$t = \frac{-(-20) \pm \sqrt{(-20)^2 - 4 \cdot 4 \cdot (-25)}}{2 \cdot 4}$

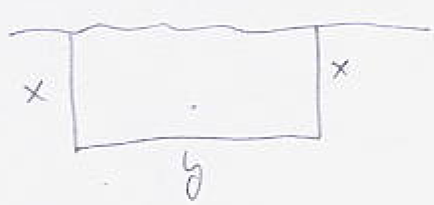
$= \frac{20 \pm \sqrt{800}}{8} = \frac{20 \pm 20\sqrt{2}}{8}$

$= \frac{5 \pm 5\sqrt{2}}{2} = \boxed{6.035534}, \underbrace{-1.035534}_{<0 \text{ so}}$

doesn't fit context

6. (14pts) Farmer Frank has 1000 meters of fencing. He would like to enclose a rectangular plot of land next to a river so that its area is the largest possible. The side of the rectangle that goes along the river does not require a fence.
a) Express the area of the enclosure as a function of the length of one of the sides. What is the domain of this function?
b) Sketch the graph the 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 enclosure that has the greatest area?

a)



$2x + y = 1000$

$y = 1000 - 2x$

$A = xy = x(1000 - 2x) = -2x^2 + 1000x$

domain: Must have

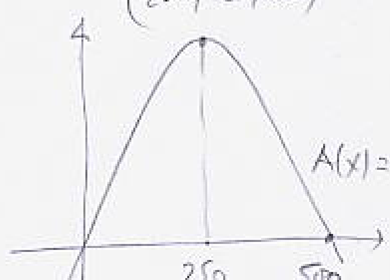
$x \geq 0 \qquad 1000 - 2x \geq 0$

$1000 \geq 2x$

$x \leq 500$

Domain $[0, 500]$

b)



$x(1000 - 2x) = 0$

$x = 0$ or $x = 500$

$A(x) = -2x^2 + 1000x$

vertex is at $-\frac{b}{2a} = -\frac{1000}{2 \cdot (-2)} = 250$

$A(250) = 250 \cdot 500 = 125000 \text{ m}^2$

Enclosure is $\underset{x}{250} \times \underset{y}{500}$.