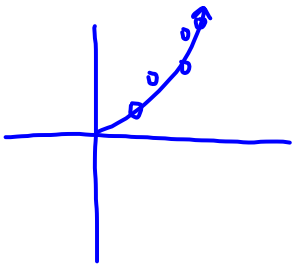
Warm-Up

A physics student obtains the following data involving a ball rolling down an inclined plane where t is the elapsed time in seconds and y is the distance traveled in inches.

t	0	1	2	3	4	5
y	0	1.2	4.8	10.8	19.2	30



Fit an algebraic model to the data. $y = kt^2$

$= (1.2)t^2$

Use your model to estimate:

a) How far did the ball roll if the total time was 10 seconds? $y = 1.2(10)^2$

$= 120$ in

b) How much time does it take for the ball to roll 100 inches? $\frac{100}{1.2} = \frac{1.2t^2}{1.2}$

$83.\bar{3} = t^2$

$9.129_s = t$

Section 1-1: Day 2

Modeling & Equation Solving

Students will be able to:

- Use numerical, algebraic and graphical models to solve problems and will be able to translate from one model to another
- Use the Zero Factor Property

Zero Product Property

A product of real numbers is zero if and only if at least one of the factors in the product is zero!

- used to solve an expression that is set equal to zero

example: (x + 2)(x - 5) = 0

$x = -2 \quad x = 5$

$x + 2 = 0$
$-2 \quad -2$
$x = -2$

- graphically, the x-intercepts of the graph will be the values for which the expression equals 0.

Solving an Equation: Comparing Methods

Solve the equation...

$x^2 = 10 - 4x$

$x^2 = 10 - 4x$
$-10+4x \quad = -10+4x$
$x^2+4x-10 = 0$

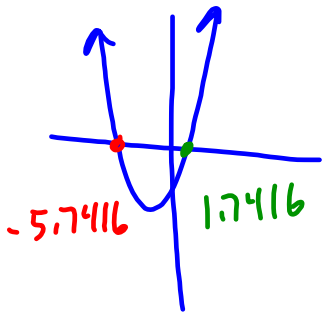
Algebraically

$x^2 + 4x - 10 = 0$

$x^2+4x-10$

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

Graphically



Find all real numbers x for which $6x^3 = 11x^2 + 10x$

$6x^3 - 11x^2 - 10x = 0$

$x(6x^2 - 11x - 10) = 0$

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

Fundamental Connection

If a is a real number that solves the equation f(x) = 0, then these three statements are equivalent.

1. The number a is a root (or solution) of the equation f(x) = 0

2. The number a is a zero of y = f(x)

3. The number a is an x-intercept of the graph of y = f(x).

Problem Solving

Polya's Four Problem-Solving Steps

1. Understand the Problem
2. Devise a Plan
3. Carry Out the Plan
4. Look Back

Applying the Problem-Solving Process

The engineers at an auto manufacturer pay students $0.80 per mile plus $25 per day to road test their new vehicles.

a) How much did the auto manufacturer pay Sally to drive 440 miles in one day?

$y = 25 + .8x$

$y = 25 + .8(440)$

$y = \$377$

b) John earned $93 test-driving a new car in one day. How far did he drive?

$93 = 25 + .8x$

$x = 85$ miles

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47. Swan Auto Rental charges $32 per day plus $0.18 per mile for an automobile rental.

a. Elaine rented a car for one day and she drove 83 miles. How much did she pay?

$y = .18x + 32$

$= .18(83) + 32$

$= \$46.94$

b. Ramon paid $69.80 to rent a car for one day. How far did he drive?

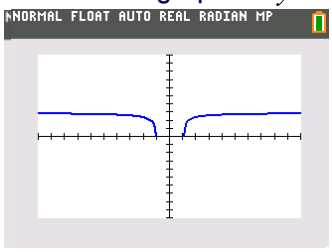
$69.80 = .18(x) + 32$

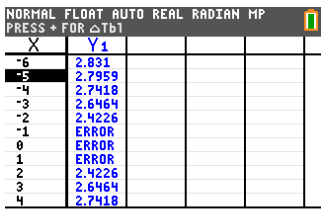
$37.80 = .18x$

$210 = x$

Seeing Grapher Failure

Look at the graph of $y = 3 - \frac{1}{\sqrt{x^2-1}}$. Are there any x-intercepts??





X=-5

$0 = 3 - \frac{1}{\sqrt{x^2-1}}$

$3 = \frac{1}{\sqrt{x^2-1}}$

$\left(\frac{1}{3}\right)^2 = \left(\sqrt{x^2-1}\right)^2$

$\frac{1}{9} = x^2 - 1$

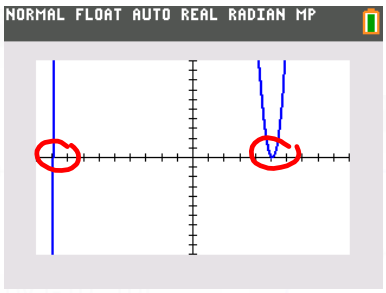
$\frac{10}{9} = x^2$

$x = \pm\sqrt{10/9} \approx \pm 1.054$

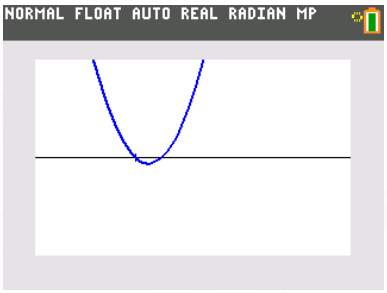
Not Seeing Hidden Behavior

Solve graphically:

$$x^3 - 1.1x^2 - 65.4x + 229.5 = 0$$

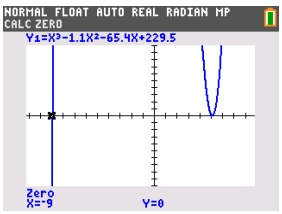


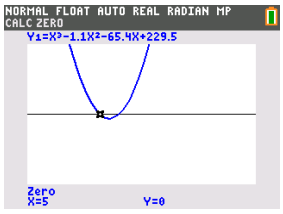
STANDARD WINDOW

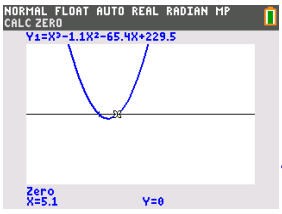


ZOOM IN x2

3 Solutions





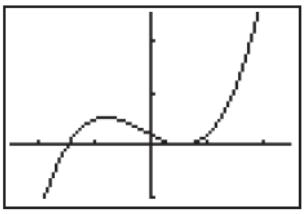


#51

51. Solve graphically, find all real solutions to the following equations. Watch out for hidden behaviors!

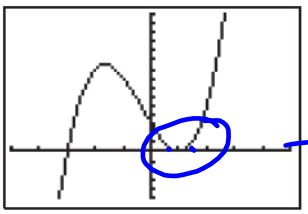
a. $y = 10x^3 + 7.5x^2 - 54.85x + 37.95$

51. (a) $x = -3$ or $x = 1.1$ or $x = 1.15$.



$[-5, 5]$ by $[-200, 500]$

(b) $x = -3$ only.



$[-5, 5]$ by $[-10, 10]$

Proving a Peculiar Number Fact

Prove that 6 is a factor of $n^3 - n$ for every positive integer n.

n	1	2	3	4	5	6	7	8	9	10	11
$n^3 - n$	0	6	24	60	120	210	336	504	720	990	1320

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53. Prove that if n is a postive integer, then $n^2 + 2n$ is either odd or a multiple of 4.

Homework:
Pg 77. #33 - 60 multiples of 3