

Happy Pay A Compliment Day!

- Park your phones
- Grab calculators
- Start warm up (1/4 sheet & on board)

Warm up

Find the Domain $f(x) = \frac{\sqrt{2x-14}}{x-7}$

a.

$$2x-14 \geq 0 \quad x-7 \neq 0$$

$$x \geq 7 \quad x \neq 7$$

↘ $x > 7$ ↙

Domain: $(7, \infty)$

b. $f(x) = x^2 + 2x$, evaluate $f\left(\frac{a+2}{a}\right)$

$$= \left(\frac{a+2}{a}\right)^2 + 2\left(\frac{a+2}{a}\right)$$

$$= \frac{a^2+4a+4}{a^2} + \frac{2a+4}{a} \left(\frac{a}{a}\right)$$

$$= \frac{a^2+4a+4}{a^2} + \frac{2a^2+4a}{a^2}$$

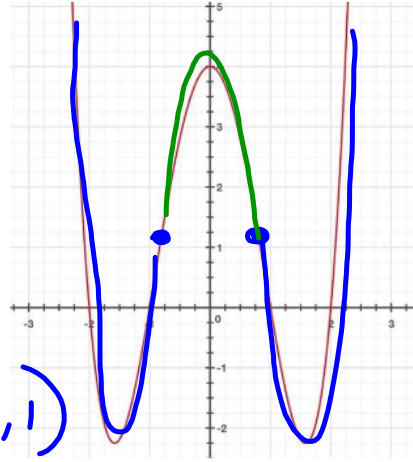
$$= \frac{3a^2+8a+4}{a^2}$$

Assume
TR

1. divide by 0
2. $\sqrt{\text{negative}}$

Quick Recap:

Using the graph, identify any maximums, minimums, and/or points of inflection.



max(relative) (0,4)

Mins (relative) (-1.5, -2.25)
(1.5, -2.25)

Pts of inflections (-0.8, 1) and (0.8, 1)

Two numbers have a sum of 13. Find the maximum product and tell the two numbers that have the maximum product.

$x + y = 13$
 $y = 13 - x$

x is the 1st
13-x is 2nd

max Product = $x(13-x)$
 $= 13x - x^2$

(1st max int.) prod.)

$= -x^2 + 13x$
 $(6.5, 42.25)$

x · y
6.5 1st, 6.5 2nd
42.25 max Product

Vertex

I want to build a 3-sided fence against the side of my house, but I only have 100 feet of fencing. What is the maximum area possible for this fence and what are its dimensions?

perimeter



$2w + L = 100$

$L = 100 - 2w$

$A = L \cdot w$

$= (100 - 2w)(w)$

$= 100w - 2w^2$

∴

$(25, 1250)$

width = 25

length = 50

Max Area = 1250

Using Synthetic Division to find polynomial roots

x-ints
zeroes

A depressed polynomial has a degree less than the original.

Use synthetic division to create a depressed polynomial, then find all zeroes.

Goal: find x-ints

$2x^3 - 3x^2 + x$; $(x - 1)$ is a factor $x = 1$ is a zero/root/x-int

$$\begin{array}{r|rrr} 1 & 2 & -3 & 1 \\ & \downarrow & 2 & -1 \\ \hline & 2 & -1 & 0 \end{array}$$

no remainder

$$\{0, \frac{1}{2}, 1\}$$

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

$$x(2x - 1) = 0$$

$$x = 0 \quad 2x - 1 = 0 \rightarrow x = \frac{1}{2}$$

$x^3 - 7x + 6$; $(x + 3)$ is a factor $x = -3$ is a root

$$\begin{array}{r|rrrr} -3 & 1 & 0 & -7 & 6 \\ & \downarrow & -3 & 9 & -6 \\ \hline & 1 & -3 & 2 & 0 \end{array}$$

no remainder

$$0 \cdot x^2$$

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

$$(x - 2)(x - 1) = 0$$

$$x = 2 \quad x = 1$$

$$\{-3, 1, 2\}$$

Example: Find all possible rational roots (only find **one** w/ calc)

$$x^3 + 8x^2 + 16x + 5 = 0$$

$x = -5$
is a root

$$\begin{array}{r|rrrr} -5 & 1 & 8 & 16 & 5 \\ & \downarrow & -5 & -15 & -5 \\ \hline & 1 & 3 & 1 & 0 \end{array}$$

$$\left\{ \frac{-3+\sqrt{5}}{2}, -5, \frac{-3-\sqrt{5}}{2} \right\}$$

$x^2 + 3x + 1 = 0$ ← Quad Form/CTS

$$\left(\frac{3}{2}\right)^2 x^2 + 3x + \frac{9}{4} = -\frac{4}{4} + \frac{9}{4}$$

$$\frac{9}{4} \left(x + \frac{3}{2}\right)^2 = \frac{5}{4}$$

$$x + \frac{3}{2} = \pm \frac{\sqrt{5}}{2}$$

$$x = -\frac{3 \pm \sqrt{5}}{2}$$

Example: Find all possible rational roots (only find **one** w/ calc)

$$x^4 - 4x^2 - 45 = 0$$

$x = 3$

$$\begin{array}{r|rrrrr} 3 & 1 & 0 & -4 & 0 & -45 \\ & \downarrow & 3 & 9 & 15 & 45 \\ \hline & 1 & 3 & 5 & 15 & 0 \end{array}$$

$$(x^3 + 3x^2) + 5x + 15 = 0$$

$$x^2(x+3) + 5(x+3) = 0$$

$$(x^2+5)(x+3) = 0$$

$$x^2 + 5 = 0$$

$$\sqrt{x^2} = \pm \sqrt{5}$$

$$x = \pm i\sqrt{5}$$

$$x = -3$$

$$\left\{ -3, -i\sqrt{5}, i\sqrt{5}, 3 \right\}$$

Rational

Example: Use synthetic division to prove (or disprove) that $(x - 5)$ is/isn't a factor of $4x^2 - 18x + 2$

$$\begin{array}{r|rrr} 5 & 4 & -18 & 2 \\ & \downarrow & 20 & 10 \\ \hline & 4 & 2 & \textcircled{12} \end{array} \text{ remainder}$$

$x = 5$
Remainder
= 0,
then
it's a
Factor?

$$4x + 2 + \frac{12}{x-5}$$

$4x + 2 \text{ rem } 12$

$$\textcircled{\frac{12}{x-5}}$$

Synthetic Division: Just divide and list the remainder (if you have one)

1. $(3x^2 + 4x - 12) \div (x + 5)$

2. $(x^2 - 5x - 12) \div (x - 3)$

3. $(x^4 - 3x^2 + 12) \div (x + 1)$

4. $(2x^3 + 3x^2 - 8x + 3) \div (x + 3)$

Finding Roots using Synthetic Division: You may use your calculator for ONE!

1. $x^3 - x^2 - 8x + 12 = 0$

2. $2x^3 - 3x^2 - 2x + 3 = 0$

3. $36x^4 - 13x^2 + 1 = 0$

3. $36x^4 - 13x^2 + 1 = 0$

(Factor this time)

4. $x^3 + 3x^2 - 6x - 8 = 0$

5. $x^4 - 3x^3 - 11x^2 + 3x + 10 = 0$

6. $x^4 + x^2 - 2 = 0$

7. $x^3 + 4x^2 - 2x + 15 = 0$

