Test 1
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Math 111

No work = no credit

No Symbolic Calculators

Name: Key

Why are numbers beautiful? It's like asking why is Beethoven's Ninth Symphony beautiful. If you don't see why, someone can't tell you. I know numbers are beautiful. If they aren't beautiful, nothing is.

Paul Erdos (1913 - 1996)
Hungarian mathematician

Warm-ups (1 pt each): $1+1=$ 2 $\quad -1^2=$ -1 $\quad \frac{1}{0}=$ undefined

1.) (1 pt) Based upon the quote above, how did Erdos explain the beauty of numbers? Answer using complete English sentences.

It can't be explained. It must be recognized.

2.) (4 pts) Solve $\frac{3x}{4}-\frac{1}{3}=1-\frac{2}{3}\left(x-\frac{1}{6}\right)$

$\Rightarrow \frac{3x}{4}-\frac{1}{3}=1-\frac{2}{3}x+\frac{2}{18}$

$\Rightarrow 27x-12=36-24x+4$

$\Rightarrow 51x=52$

$\Rightarrow x=52/51$

3.) (4 pts) Find and interpret market equilibrium for the following supply and demand functions: $D: p=480-3q$ and $S: p=17q+80$.

$480-3q=17q+80$

$\Rightarrow 400=20q$

$\Rightarrow q=20$

and $p=420$.

Market equilibrium is when 20 units are sold/bought for \$420 ea.

4.) (4 pts) Suppose a manufacturer models its monthly costs with $C(x) = 35x + 9800$ where x is in hundreds of units produced in a month and C is in dollars.

a.) Find and interpret the C-intercept.

There are fixed costs of $9800.

b.) Find and interpret the slope.

- There are variable costs of $35/unit.
- For each additional 100 units produced, costs increase $35.

5.) (4 pts) The table gives the percent of the U.S. population that is foreign born.

a.) Find a cubic model $f(x)$ for the data where x is given in years since 1900.

$f(x) = 0.000057 1x^3 - 0.00649x^2 + 0.0446x + 14.181$ ☺

Year	% born abroad
1900	13.6
1910	14.7
1920	13.2
1930	11.6
1940	8.8
1950	6.9
1960	5.4
1970	4.7
1980	6.2
1990	8
2000	10.4
2002	11.5

b.) Find and interpret $f(112)$

$f(112) = 17.919$

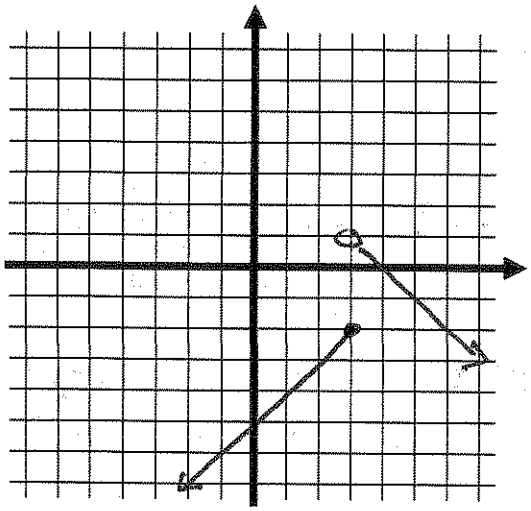
In 2012, about 17.9% of the US. pop is foreign born.

6.) (4 pts) Consider $g(x) = \begin{cases} x-5, & x \le 3 \\ 4-x, & x > 3 \end{cases}$

a.) Evaluate $g(6)$

$g(6) = -2$

b.) Carefully sketch a graph of $g(x)$



7.) (4 pts) Find a good viewing window for $h(x) = 0.03x - 6000$

y-int: $(0, -6000)$

$0 = 0.03x - 6000$

x-int.

$\Rightarrow \frac{6000}{0.03} = x$

$[-50000, 250000] \times [-7000, 1000] \Rightarrow x = 200{,}000$

8.) (4 pts) Solve $5x^2 = 2x + 6$ using any method.

$5x^2 - 2x - 6 = 0$

$x = \frac{2 \pm \sqrt{4 - 4(5)(-6)}}{2(5)}$

$= \frac{2 \pm \sqrt{124}}{10}$

$x \approx 1.31$ or $x \approx -0.91$

9.) (8 pts) A certain company has fixed costs of $15,000 for its product and variable costs given by $35 + 0.1x$ dollars per unit, where x is the total number of units. The selling price of the product is given by $285 - 0.9x$ dollars per unit.

a.) Formulate the functions for total cost, revenue, and profit.

$C(x) = (35 + 0.1x)x + 15000 = 0.1x^2 + 35x + 15000$

$R(x) = (285 - 0.9x)x = -0.9x^2 + 285x$

$P(x) = -0.9x^2 + 285x - (0.1x^2 + 35x + 15000)$

$= -x^2 + 250x - 15000$

b.) Algebraically find and interpret the break even points.

$P(x) = -x^2 + 240x - 15000$

Solve $0 = -x^2 + 250x - 15000$

$$x = \frac{-250 \pm \sqrt{250^2 - 4(-1)(-15000)}}{2(-1)}$$

$x = 100$ or $x = 150$

The company breaks even when 100 or 150 units are produced/sold.

c.) Algebraically find and interpret the level of production and sales that maximizes profit.

$x = 125$ (mid pt).

$$x = \frac{-250}{+2(-1)} = 125$$

Sell 125 units to max profit.

$P(125) = 625$

d.) Find and interpret the profit (or loss) at the production level found in (c.)

The max profit is $625.