HW 5 – 9

1. $Q(x) = x^2 + 2$
   $R(x) = 2$
   $P(-3) = 2$ ✓

2. $Q(x) = x^2 + 3x + 4$
   $R(x) = 4$
   $P(-2) = 4$ ✓

3. $P(2) = 0$
   yes

4. $P(-2) = 16$
   no

5. $a = -7$

6. Graph see next page
   increasing: $(-2, 0), (2, \infty)$
   decreasing: $(-\infty, -2), (0, 2)$
   rel min: $(-2, 0), (2, 0)$
   rel max: $(0, 16)$

7. Graph see next page
   increasing: $(-\infty, .21), (3.12, \infty)$
   decreasing: $(.21, 3.12)$
   rel min: $(3.12, -4.06)$
   rel max: $(.21, 8.21)$

For 1 & 2:

a. Use long division to find the quotient (Q(x)) and remainder (R(x)).

b. Verify your remainder with the remainder theorem.

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

space

$$\begin{array}{r} x^2 + 2 \\ x+3 \overline{)\, x^3 + 3x^2 + 2x + 8} \\ -(x^3 + 3x^2) \\ \hline 2x + 8 \\ -(2x + 6) \\ \hline 2 \end{array}$$

$Q(x) = x^2 + 2$

$R(x) = 2$

$P(-3) = (-3)^3 + 3(-3)^2 + 2(-3) + 8$

$P(-3) = 2$ ✓

2. $(x^3 + 5x^2 + 10x + 12) \div (x + 2)$

space

$$\begin{array}{r} x^2 + 3x + 4 \\ x+2 \overline{)\, x^3 + 5x^2 + 10x + 12} \\ -(x^3 + 2x^2) \\ \hline 3x^2 + 10x \\ -(3x^2 + 6x) \\ \hline 4x + 12 \\ -(4x + 8) \\ \hline 4 \end{array}$$

remainder

$Q(x) = x^2 + 3x + 4$

$R(x) = 4$

$P(-2) = (-2)^3 + 5(-2)^2 + 10(-2) + 12$

$P(-2) = -8 + 20 - 20 + 12$

$P(-2) = 4$ ✓

In 3 & 4, using the binomial theorem, determine if the given binomial is a factor of the given polynomial.

3. $(x^4 - 8x^3 + 10x^2 + 2x + 4) \div (x - 2)$

$P(2) = 2^4 - 8(2)^3 + 10(2)^2 + 2(2) + 4$

$P(2) = 16 - 64 + 40 + 8$

$P(2) = 0$

$\therefore$ yes

4. $(x^4 + 10x^3 + 21x^2 + 6x + 8) \div (x + 2)$

$P(-2) = (-2)^4 + 10(-2)^3 + 21(-2)^2 + 6(-2) + 8$

$P(-2) = 16 - 80 + 84 - 12 - 8$

$P(-2) = 16$

$\therefore$ no

5. Find the value of a if $x^3 + 8x^2 + ax - 2$ is divisible by $(x - 1)$

$P(1) = 0$

$1^3 + 8(1)^2 + 1(a) - 2 = 0$

$1 + 8 + a - 2 = 0$

$7 + a = 0$

$a = -7$

$\therefore R = 0$
$P(1) = 0$

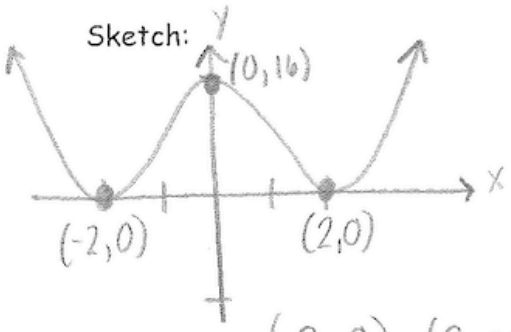
In 6 & 7, state the degree of the polynomial, find the zeros of each polynomial, state the multiplicity of each. Sketch. Using your calculator, determine relative min/max and where it's increasing/decreasing.

6. $P(x) = (x + 2)^2(x - 2)^2$

Degree: 4 +

Z	M	T/C
-2	2	T
2	2	T

Sketch:



Increasing: $(-2,0), (2,\infty)$

Decreasing: $(-\infty,-2), (0,2)$

Rel Min: $(-2,0), (2,0)$

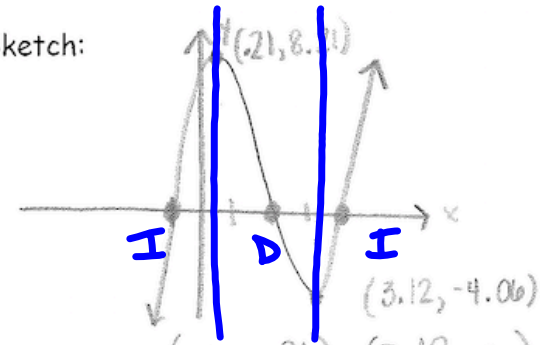
Rel Max: $(0,16)$

7. $Q(x) = (x + 1)(x - 2)(x - 4)$

Degree: 3 +

Z	M	T/C
-1	1	C
2	1	C
4	1	C

Sketch:



Increasing: $(-\infty, .21), (3.12, \infty)$

Decreasing: $(.21, 3.12)$

Rel Min: $(3.12, -4.06)$

Rel Max: $(.21, 8.21)$

Even & Odd

Functions

YOU WILL NEED YOUR PHONE FOR NOTES TODAY!

Not the same as odd/Even degree → end behav.

Even Function → A function is **even** if f(-x) = f(x) for every x in the domain of f(x).

Odd Function → A function is **odd** if f(-x) = -f(x) for every x in the domain of f(x).

What does this mean?

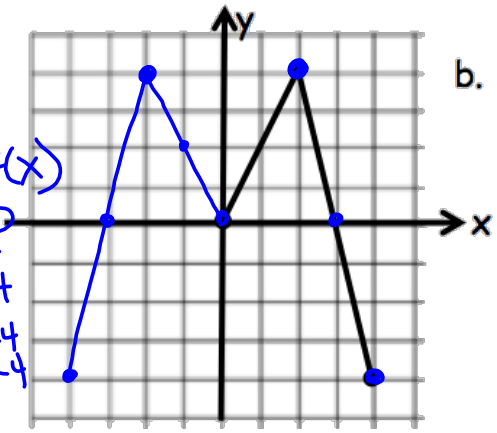
f(-x)

Even → Sub in -x ⇒ same then even

Odd → Sub in -x ⇒ oppo. then odd

Given the **partial graph** of function f shown below. Sketch the other half of the function in a) if f(x) is **even** and in b) if f(x) is **odd**. Find f(-x) for each of the indicated points.

a.



Even

$f(-x) = f(x)$

$f(0) = 0$

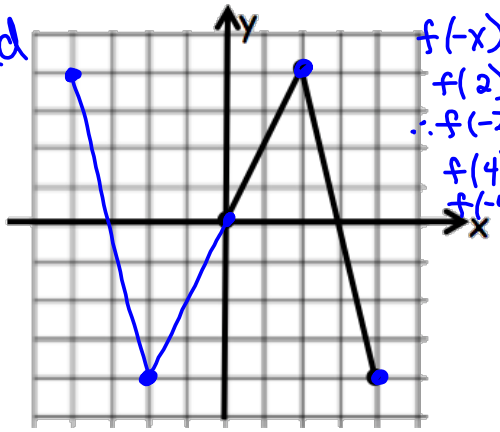
$f(2) = 4$

$\therefore f(-2) = 4$

$f(4) = -4$

$f(-4) = -4$

b. odd



$f(-x) = -f(x)$

$f(2) = 4$

$\therefore f(-2) = -4$

$f(4) = -4$

$f(-4) = 4$

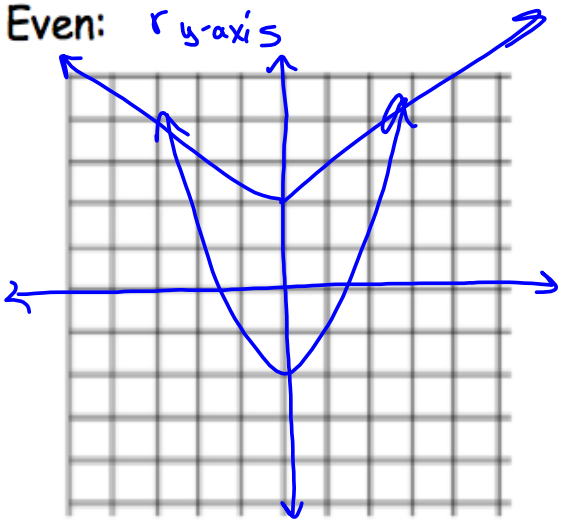
What can you say about each of the functions graphically (think symmetry)

Even → symmetrical w/r/t the y-axis ($r_{y\text{-axis}}$)

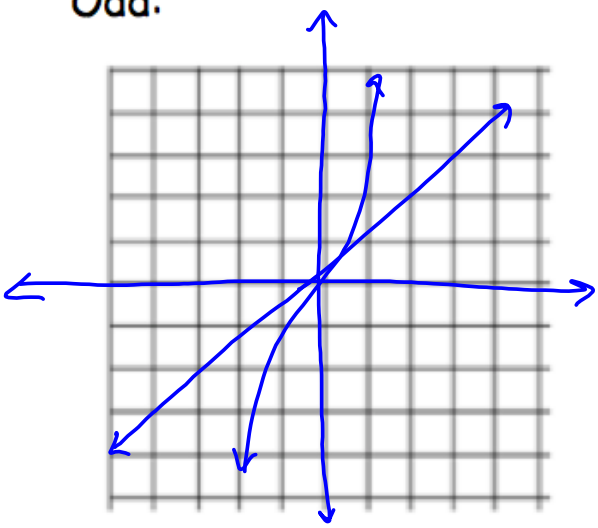
Odd → symmetrical w/r/t the origin (r_{origin})

Think about all of the functions we have studied so far this year. Sketch a graph of an even function and an odd function and state the equation of each.

Even: r y-axis



Odd:



Determine Graphically whether a function is odd or even - Quick 5 Question Kahoot

Determine algebraically whether each of the following functions is even, odd, or neither.

$f(-x) = f(x) \Rightarrow$ Even

1. $f(x) = 3x^2 + x - 1$

$f(-x) = 3(-x)^2 + (-x) - 1$

$f(-x) = 3x^2 - x - 1$

Neither

$f(-x) = -f(x) \Rightarrow$ odd

2. $f(x) = \dfrac{x}{x^2 - 1}$

$-\frac{2}{7} \rightarrow \frac{2}{7}$

$f(-x) = \dfrac{-x}{(-x)^2 - 1} = \dfrac{-x}{x^2 - 1}$

oppo.

∴ odd

3. $f(x) = |x| + 2$

$f(-x) = |-x| + 2$

$f(x) = |x| + 2$

same

$\therefore$ Even

4. $f(x) = x^3 - x$

$f(-x) = (-x)^3 - (-x)$

$f(-x) = -x^3 + x$

oppo.

$\therefore$ odd

Given the partially filled out table below for f(x), fill in the rest of the table based on the function type.

5. Even $f(-x) = f(x)$

x	-3	-2	-1	0	1	2	3
y	-15	-5	1	3	1	-5	-15

6. Odd $f(-x) = -f(x)$

x	-3	-2	-1	0	1	2	3
y	-21	-4	1	0	−1	4	21

$f(-x) = f(x)$ $f(-3) = 5$

7. If f(x) is an even function and f(3) = 5 then what is the value of 4f(3) + 2f(-3)?

a. 30 b. 10

c. 60 d. 6

$4(5) + 2(5)$

30

HOMEWORK: 5-10