Name ___Key___

Period _____

#1. Determine left and right hand behavior of the graph of: $f(x) = -2x^4 - x^3 - 3x^2 + x - 2$

down   even

LH ___↙___   RH ___↘___

#2. Sketch the graph of the function: $f(x) = x^5 - 2x^4 - 3x^3$

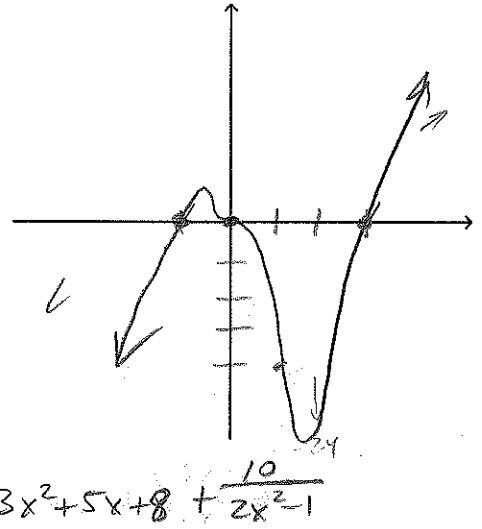LH ___↙___   RH ___↗___

Zeros: ___0, -1, 3___

$x^3(x^2 - 2x - 3)$

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

M 3

$f(1) = 1 - 2 - 3$
$\quad\quad -4$

$f(2) = 32 - 32 - 3(8)$

#3. Divide: $(6x^4 + 10x^3 + 13x^2 - 5x + 2) \div (2x^2 - 1)$

$$3x^2 + 5x + 8 + \frac{10}{2x^2 - 1}$$

$$
\begin{array}{r}
3x^2 + 5x + 8 \\
2x^2 - 1\overline{\smash{\big)}\,6x^4 + 10x^3 + 13x^2 - 5x + 2} \\
\underline{6x^4 \quad\quad\quad -3x^2} \\
10x^3 + 16x^2 - 5x \\
\underline{10x^3 \quad\quad -5x} \\
16x^2 \quad\quad + 2 \\
\underline{16x^2 \quad\quad -8} \\
10
\end{array}
$$

#4. Use synthetic division to find : $f(2)$: $f(x) = -x^4 + 2x^3 - x^2 + 3x - 1$ ___1___

$$
\begin{array}{c|ccccc}
2 & -1 & 2 & -1 & 3 & -1 \\
  &   & -2 & 0 & -2 & 2 \\
\hline
  & -1 & 0 & -1 & 1 & \boxed{1}
\end{array}
$$

#5. Find all real zeros of the polynomial function: $f(x) = x^4 + 2x^3 - 15x^2$

$x^2(x^2 + 2x - 15)$

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

$0 \quad -5 \quad 3$

Zeros: ___-5, 0, 3___

#6. List the possible rational zeros of the function: $f(x) = 3x^3 - 2x^2 + x - 15$

$$\frac{\pm \text{ last term}}{\pm 1^{st} \text{ term}} = \frac{\pm 1, \pm 3, \pm 5, \pm 15}{\pm 1, \pm 3}$$

$$\pm 1, \pm 3, \pm 5, \pm 15, \pm \frac{1}{3}, \pm \frac{5}{3}$$

#7. Write in the form $y = a(x-h)^2 + k$:

$$y = -2(x-5)^2 + 8$$

$$y = -2x^2 + 20x - 42$$

$$y = -2(x^2 - 10) - 42$$
$$y = -2(x^2 - 10 + 25) - 42 + 50$$
$$y = -2(x-5)^2 + 8$$

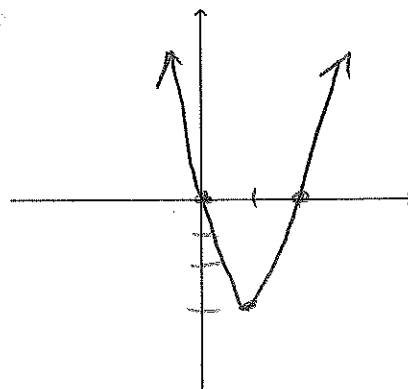**#8.** Sketch the graph of $f(x) = 3(x-1)^2 - 3$

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

Find and label the vertex, x-intercepts and y-intercept:

Vertex $(1, -3)$

x-intercepts: $(0, 0), (2, 0)$

y-intercepts: $(0, 0)$

x-int ($y=0$)

$0 = 3(x-1)^2 - 3$
$3 = 3(x-1)^2$
$1 = (x-1)^2$
$\pm 1 = x - 1$
$x = 1 \pm 1$
$0, 2$

y-int ($x=0$)

$y = 3(0-1)^2 - 3$
$y = 3(-1)^2 - 3$
$y = 3 - 3$
$y = 0 \quad (0, 0)$

#9. Simplify and write in standard form:

(a) $(6 - 2i)(2 - 3i)$

$12 - 18i - 4i + 6i^2$
$12 - 6 - 22i$
$\boxed{6 - 22i}$

(b) $\sqrt{-20} \cdot \sqrt{-3}$

$\sqrt{20}\sqrt{-1} \cdot \sqrt{3}\sqrt{-1}$
$\sqrt{20}i \cdot \sqrt{3}i$
$\sqrt{4}\sqrt{5}\sqrt{3}i^2$
$\boxed{-2\sqrt{15}}$

(c) $\dfrac{8 - 7i}{1 - 2i} \dfrac{(1 + 2i)}{(1 + 2i)}$

$\dfrac{8 + 16i - 7i - 14i^2}{1 + 2i - 2i - 4i^2}$

$\dfrac{8 + 9i - 14(-1)}{1 - 4(-1)}$

$\dfrac{22 + 9i}{5}$

$\boxed{\dfrac{22}{5} + \dfrac{9}{5}i}$

(d) $\dfrac{(2 - 3i)(5i)}{(2 + 3i)}\dfrac{(2 - 3i)}{(2 - 3i)}$

$\dfrac{(10i - 15i^2)(2 - 3i)}{4 - 6i + 6i - 9i^2}$

$\dfrac{(15 + 10i)(2 - 3i)}{4 + 9}$

$\dfrac{30 - 45i + 20i - 30i^2}{13}$

$\dfrac{60 - 25i}{13}$

$\boxed{\dfrac{60}{13} - \dfrac{25}{13}i}$

#10. Find the zeros of: $f(x) = 2x^3 - 3x^2 + 2x - 1$

# of possible + real zeros: ___3 or 1___ $\pm\frac{}{}\pm$ $\frac{\pm1}{\pm1, \pm2}$

# of possible – real zeros: ___none___

List all possible rational zeros: ___$\pm 1, \pm\frac{1}{2}$___

Use the remainder/factor theorems, synthetic division and factoring to find all zeros.

$1, \frac{1}{4}+\frac{\sqrt{7}}{4}i, \frac{1}{4}-\frac{\sqrt{7}}{4}i$

try 1

$\begin{array}{c|ccc} 1 & 2 & -3 & 2 & -1 \\ & & 2 & -1 & 1 \\ \hline & 2 & -1 & 1 & 0 \end{array}$

$(x-1)(2x^2 - x + 1)$

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

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

$= \frac{1 \pm \sqrt{1-8}}{4}$

$= \frac{1 \pm \sqrt{-7}}{4}$

$= \frac{1 \pm \sqrt{7}i}{4}$

#11. Find the zeros of: $f(x) = -4x^3 + 2x - 2$

# of possible + real zeros: ___2 or 0___ $-+-$ $\frac{\pm1, \pm2}{\pm1, \pm2, \pm4}$

# of possible – real zeros: ___1___ $+--$

List all possible rational zeros: ___$\pm 1, \pm 2, \pm\frac{1}{2}, \pm\frac{1}{4}$___

Use the remainder/factor theorems, synthetic division and factoring to find all zeros.

$-1, \frac{1}{2}+\frac{1}{2}i, \frac{1}{2}-\frac{1}{2}i$

try 1
$\begin{array}{c|ccc} 1 & -4 & 0 & 2 & -2 \\ & & -4 & -4 & -2 \\ \hline & -4 & -4 & -2 & -4 \end{array}$
(no)

try -1
$\begin{array}{c|ccc} -1 & -4 & 0 & 2 & -2 \\ & & 4 & -4 & 2 \\ \hline & -4 & 4 & -2 & 0 \end{array}$
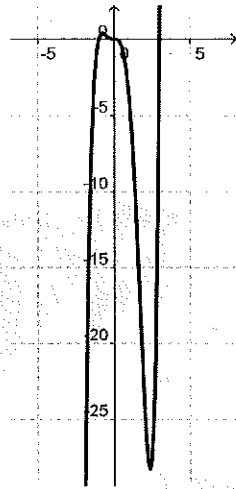yes

$(x+1)(-4x^2 + 4x - 2)$

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

$= \frac{-4 \pm \sqrt{16-32}}{-8}$

$= \frac{-4 \pm \sqrt{-16}}{-8}$

$= \frac{-4 \pm 4i}{-8}$

$= \frac{1}{2} \pm \frac{1}{2}i$

Answers:

#1. LH: down   RH: down

#2. LH: down   RH: up
    Zeros: 0 (multiplicity 3),
            3 (multiplicity 1),
           -1 (multiplicity 1)
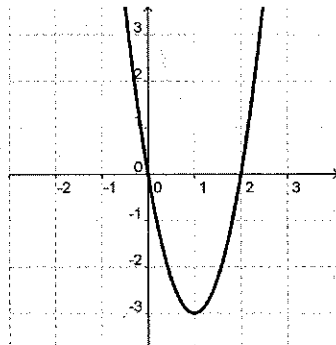
#3. $3x^2 + 5x + 8 + \dfrac{10}{2x^2 - 1}$

#4. 1

#5. Zeros: -5, 0, 3

#6. $\pm 1, \pm 3, \pm 5, \pm 15, \pm\dfrac{1}{3}, \pm\dfrac{5}{3}$

#7. $y = -2(x-5)^2 + 8$

#8. vertex: (1, -3)
    x-intercepts: (0, 0), (2, 0)
    y-intercept: (0, 0)

#9. (a) $6 - 22i$ (b) $-2\sqrt{15}$ (c) $\dfrac{22}{5} + \dfrac{9}{5}i$ (d) $\dfrac{60}{13} - \dfrac{25}{13}i$

#10. possible real pos. zeros: 3 or 1
     possible real neg. zeros: none

     list possible rational zeros: $\pm 1, \pm\dfrac{1}{2}$

     Zeros: 1, $\dfrac{1}{4} + \dfrac{\sqrt{7}}{4}i$, $\dfrac{1}{4} - \dfrac{\sqrt{7}}{4}i$

#11. possible real pos. zeros: 2
     possible real neg. zeros: 1

     list possible rational zeros: $\pm 1, \pm 2, \pm\dfrac{1}{2}, \pm\dfrac{1}{4}$

     Zeros: -1, $\dfrac{1}{2} + \dfrac{1}{2}i$, $\dfrac{1}{2} - \dfrac{1}{2}i$
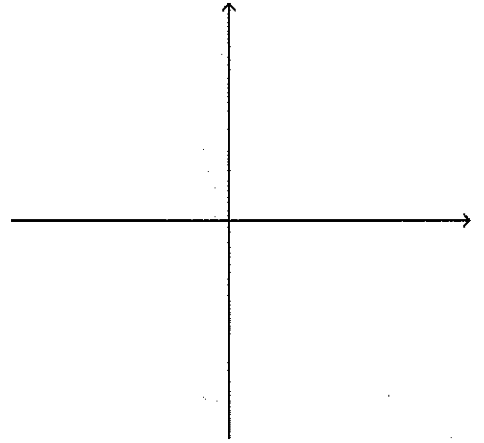
Name_____

Period_____

#1. Determine left and right hand behavior of the graph of: $f(x) = -2x^4 - x^3 - 3x^2 + x - 2$

LH _____   RH _____

#2. Sketch the graph of the function: $f(x) = x^5 - 2x^4 - 3x^3$

LH _____   RH _____

Zeros: _____

#3. Divide: $(6x^4 + 10x^3 + 13x^2 - 5x + 2) \div (2x^2 - 1)$

_____

#4. Use synthetic division to find : $f(2)$: $f(x) = -x^4 + 2x^3 - x^2 + 3x - 1$ _____

#5. Find all real zeros of the polynomial function: $f(x) = x^4 + 2x^3 - 15x^2$

Zeros: _____

#6. List the possible rational zeros of the function: $f(x) = 3x^3 - 2x^2 + x - 15$
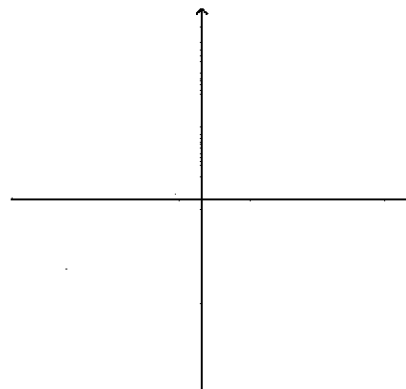
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$$y = -2x^2 + 20x - 42$$

#8. Sketch the graph of $f(x) = 3(x-1)^2 - 3$
Find and label the vertex, x-intercepts and y-intercept:

Vertex _____

x-intercepts: _____

y-intercepts: _____

#9. Simplify and write in standard form:

(a) $(6-2i)(2-3i)$

(b) $\sqrt{-20} \cdot \sqrt{-3}$

(c) $\dfrac{8-7i}{1-2i}$

(d) $\dfrac{(2-3i)(5i)}{2+3i}$

#10. Find the zeros of: $f(x) = 2x^3 - 3x^2 + 2x - 1$

# of possible + real zeros: _____

# of possible − real zeros: _____

List all possible rational zeros: _____

Use the remainder/factor theorems, synthetic division and factoring to find all zeros.

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#11. Find the zeros of: $f(x) = -4x^3 + 2x - 2$

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