Algebra 2 Name:_____

Unit 6 – Day 1 – Evaluating and Terminology of Polynomial Functions Period:_____Date:_____

Decide whether the function is a polynomial function. ***If so, write it in standard form and state its degree, type, and leading coefficient.***

1. $h(x) = -\frac{5}{2}x^3 + 3x - 10$

Yes

$Degree: 3$

$Type: Cubic$

$LC: -\frac{5}{2}$

2. $f(x) = 6x + 8x^4 - 3$

Yes

$f(x) = 8x^4 + 6x - 3$

$Degree: 4$

$Type: Quartic$

$LC: 8$

3. $h(x) = x^3\sqrt{10} + 5x^{-2} + 1$

Not a Polynomial

Use direct substitution to evaluate the polynomial function for the given value of x.

4. $f(x) = 8x + 5x^4 - 3x^2 - x^3; x = 2$

$f(2) = 76$

5. $g(x) = 4x^3 - 2x^5; g(-3)$

$g(-3) = 378$

Use synthetic substitution to evaluate the polynomial function for the given value of x.

6. $f(x) = 8x^4 + 12x^3 + 6x^2 - 5x + 9; x = -2$

$f(5) = 75$

7. $g(x) = x^3 + 8x^2 - 7x + 35; x = -6$

$g(-6) = 149$

8. $h(x) = -8x^3 + 14x - 35; x = 4$

$h(4) = -491$

9. $f(x) = -2x^4 + 3x^3 - 8x + 13; x = 2$

$f(2) = -11$

10. $g(x) = 6x^5 + 10x^3 - 27; x = -3$ $\quad g(-3) = -1755$

11. Describe and correct the error n evaluating the polynomial function $f(x) = -4x^4 + 9x^2 - 21x + 7$ **when** $x = -2$.

−2	−4	9	−21	7
		8	−34	110
	−4	17	−55	117

−2	−4	9	−21	7
		8	−34	110
	−4	17	−55	117

The coefficient of x^3 was left out, so they needed to add a zero between -4 and 9

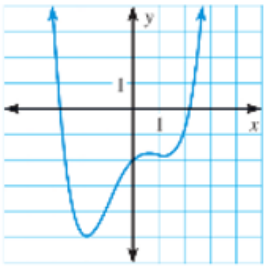
-2	-4	0	9	-21	7
		8	-16	14	14
	-4	8	-7	-7	21

Algebra 2 Name:_____

Unit 6 – Day 2 – Positive/Negative Intervals, End Behavior, and Graphing Period:_____Date:_____

Describe the degree as even or odd then state if the leading coefficient is positive or negative for the polynomial function whose graph is shown.

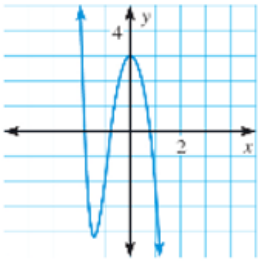
1.



Degree: *even*

Leading Coefficient: *positive*

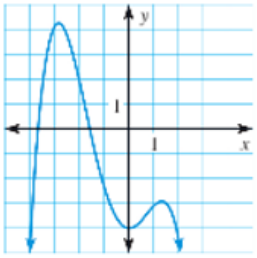
2.



Degree: *odd*

Leading Coefficient: *negative*

3.



Degree: *even*

Leading Coefficient: *negative*

Describe the end behavior of the graph of the polynomial function by completing the statements.

4. $f(x) = -2x^3 + 7x - 4$

$f(x) \to$ $+\infty$ $as\ x \to -\infty\ and$

$f(x) \to$ $-\infty$ $as\ x \to \infty$

5. $f(x) = x^7 + 3x^4 - x^2$

$f(x) \to$ $-\infty$ $as\ x \to -\infty\ and$

$f(x) \to$ $+\infty$ $as\ x \to \infty$

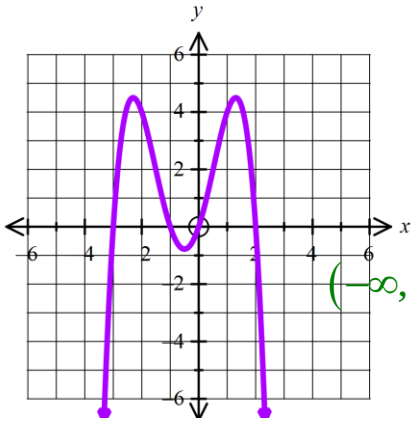
6. $f(x) = 3x^{10} - 16x$

$f(x) \to$ $+\infty$ $as\ x \to -\infty\ and$

$f(x) \to$ $+\infty$ $as\ x \to \infty$

Find the positive and negative intervals:

7.

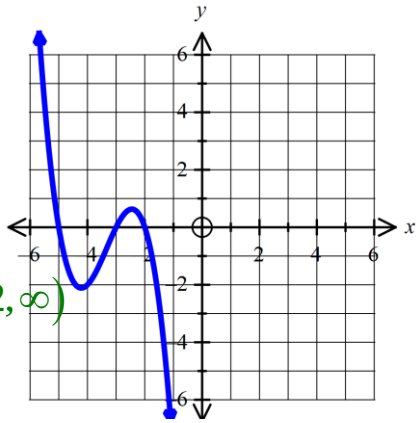


Zeros: $x = -3, -1, 0, 2$

Positive: $(-3,-1)U(0,2)$

Negative: $(-\infty,-3)U(-1,0)U(2,\infty)$

8.



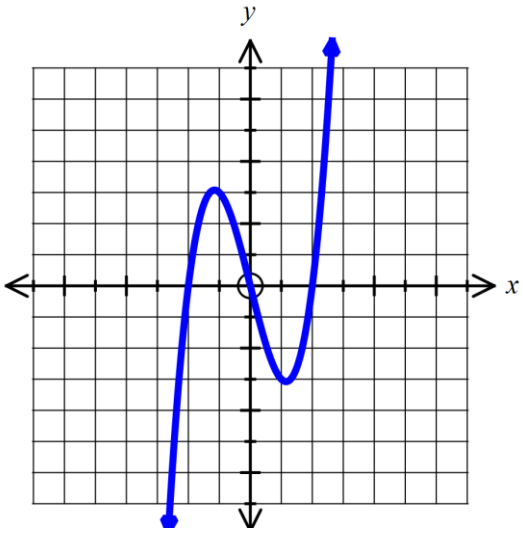
Zeros: $x = -5, -3, -2$

Positive: $(-\infty,-5)U(-3,-2)$

Negative: $(-5,-3)U(-2,\infty)$

Graph the polynomial functions. State the Degree, Leading Coefficient, Domain, Range, End Behavior, and the Intervals where the function is positive and negative.

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



Positive: $(-2,0)U(2,\infty)$

Negative: $(0,2)$

Degree: 3

Leading coefficient: 1

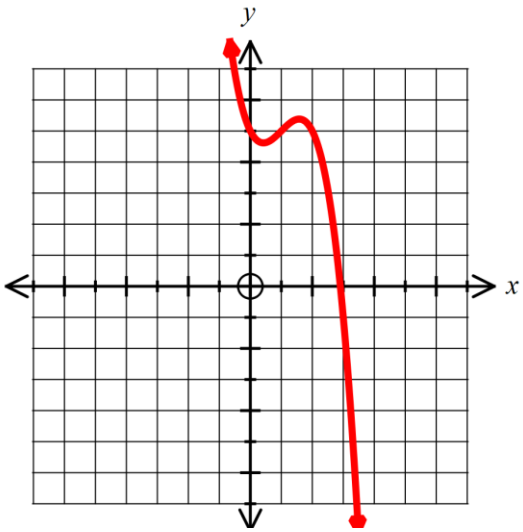
Domain: ARN

Range: ARN

$f(x) \to$ $-\infty$ $as\ x \to -\infty\ and$

$f(x) \to$ $+\infty$ $as\ x \to \infty$

10. $f(x) = -x^3 + 3x^2 - 2x + 5$



Positive: $(-\infty,3)$

Negative: $(3,\infty)$

Degree: 3

Leading coefficient: -1

Domain: ARN

Range: ARN

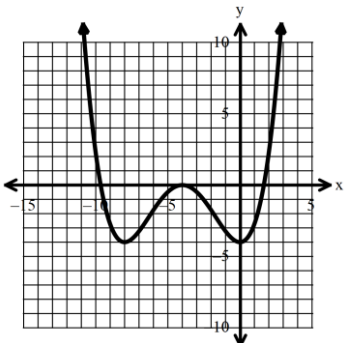
$f(x) \to$ $+\infty$ $as\ x \to -\infty\ and$

$f(x) \to$ $-\infty$ $as\ x \to \infty$

Algebra 2
UNIT 6: Day 3 Worksheet

Name:_____
Period:_____Date:_____

1. State where the function is increasing and decreasing.



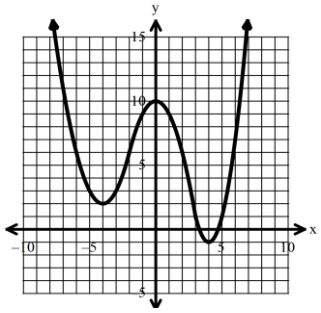
A. Never Increasing , Decreasing: $(-\infty, +\infty)$

B. Increasing: $(-8, 0) \cup (0, +\infty)$, Decreasing: $(-\infty, -8)$

C. Increasing: $(-\infty, -8) \cup (0, 8)$, Decreasing: $(-8, 0)$

D. Increasing: $(-8, -4) \cup (0, +\infty)$, Decreasing: $(-\infty, -8) \cup (-4, 0)$

2. What are the values of the relative maxima and/or minima of the function graphed?



A. relative maxima: 0 , relative minima: $-4, 4$

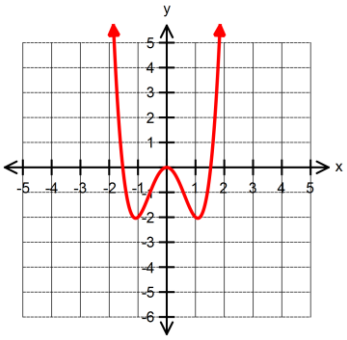
B. relative maxima: 10, relative minima: $-1, 2$

C. relative maxima: $3.3, 4.7$, relative minima: 0

D. relative maxima: $2, 10$, relative minima: -1

<u>For the following, state the relative maxima/minima, state when it is increase and decreasing, and the end behavior.</u>

3.



Maxima: $(0,0)$

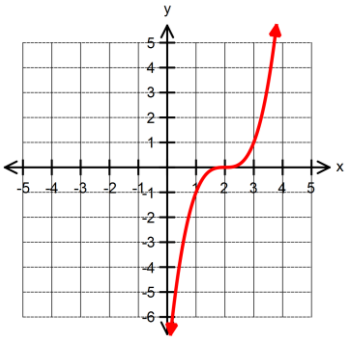
Minima: $(-1,-2)\,\&\,(1,-2)$

Increasing: $(-1,0)U(1,\infty)$

Decreasing: $(-\infty,-1)U(0,1)$

$f(x) \to$ $+\infty$ **as** $x \to -\infty$
and $f(x) \to$ $+\infty$ **as** $x \to \infty$

4.



Maxima: *None*

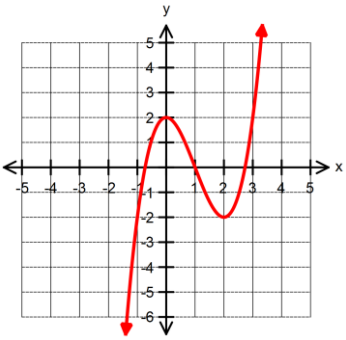
Minima: *None*

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

Decreasing: *None*

$f(x) \to$ $-\infty$ **as** $x \to -\infty$
and $f(x) \to$ $+\infty$ **as** $x \to \infty$

5.



Maxima: $(0,2)$

Minima: $(2,-2)$

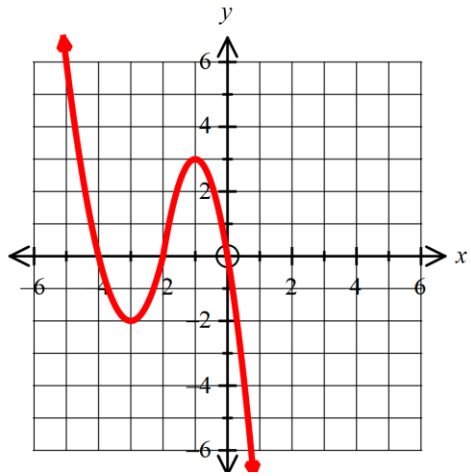
Increasing: $(-\infty,0)U(2,\infty)$

Decreasing: $(0,2)$

$f(x) \to$ $-\infty$ **as** $x \to -\infty$
and $f(x) \to$ $+\infty$ **as** $x \to \infty$

Using the graph below, find all of the following.

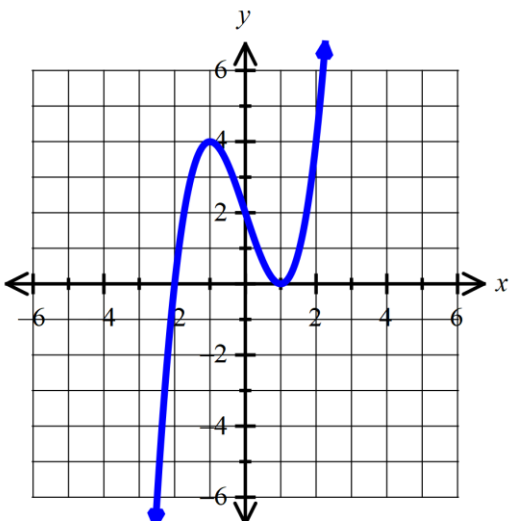
6.



Local Min	$(-3,-2)$
Local Max	$(-1,3)$
Increasing	$(-3,-1)$
Decreasing	$(-\infty,-3)U(-1,\infty)$
Positive	$(-\infty,-4)U(-2,0)$
Negative	$(-4,-2)U(0,\infty)$
End Behavior	$f(x)\to$ $+\infty$ as $x\to-\infty$ and $f(x)\to$ $-\infty$ as $x\to\infty$

Sketch a graph of the following polynomial functions by using their local minima or maxima, describe the end behavior and the intervals in which the function is increasing or decreasing.

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



Local Min	$(1,0)$
Local Max	$(-1,4)$
Increasing	$(-\infty,-1)U(1,\infty)$
Decreasing	$(-1,1)$
Positive	$(-2,1)U(1,\infty)$
Negative	$(-\infty,-2)$
End Behavior	$f(x)\to$ $-\infty$ as $x\to-\infty$ and $f(x)\to$ $+\infty$ as $x\to\infty$

x	–3	–2	–1	0	1	2	3
f(x)	-16	0	4	2	0	4	20

Algebra 2 **Name:**_____

Unit 6 – Day 4 – Add, Subtract and Multiply Polynomials **Period:**_____**Date:**_____

<u>Find the sum or difference</u>

1. $(x^2-3x+5)-(-4x^2+8x+9)$

$5x^2-11x-4$

2. $(2a^2-8)-(a^3+4a^2-12a+4)$

$-a^3-2a^2+12a-12$

3. $(3y^2-6y^4+5-6y)+(5y^4-6y^3+4y)$

$-y^4-6y^3+3y^2-2y+5$

4. $(8v^4-2v^2+v-4)-(3v^3-12v^2+8v)$

$8v^4-3v^3+10v^2-7v-4$

<u>Find the product of the polynomials.</u>

5. $(3z+1)(z-3)$

$3z^2-8z-3$

6. $(w+4)(w^2+6w-11)$

$w^3+10w^2+13w-44$

7. $(2a-3)(a^2-10a-2)$

$2a^3-23a^2+26a+6$

8. $(-x^2+4x+1)(x^2-8x+3)$

$-x^4+12x^3-34x^2+4x+3$

Find the product of the binomials.

9. $(3p+1)(p+3)(p+1)$

$3p^3+13p^2+13p+3$

10. $(b-2)(2b-1)(-b+1)$

$-b^3+7b^2-7b+2$

Algebra 2 Name:_____

Unit 6 – Day 5 – Multiply Polynomials using Special Product Patterns Period:_____Date:_____

***Describe* and *correct* the error in simplifying the expression.**

1.

$$(2x-7)^3 = (2x)^3 - 7^3$$
$$= 8x^3 - 343$$

The cube of a binomial $(a-b)^3$ is found by $a^3 - 3a^2b + 3ab^2 - b^3$; $(2x-7)^3 = (2x)^3 - 3(2x)^2(7) + 3(2x)(7)^2 - (7)^3$, $= 8x^3 - 84x^2 + 294x + 343$.

Find the product of the expressions.

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

$x^2 - 25$

3. $(w-9)^2$

$w^2 - 18w + 81$

4. $(y+4)^2$

$y^2 + 8y + 16$

5. $(2c+5)^2$

$4c^2 + 20c + 25$

6. $(5p-3)(5p+3)$

$25p^2 - 9$

7. $(7x-y)^3$

$343x^3 - 147x^2y + 21xy^2 - y^3$

8. $(3x+7y)^3$

$27x^3+189x^2y+441xy^2+343y^3$

9. ★ **MULTIPLE CHOICE** Which expression is equivalent to $(3x-2y)^2$?

Ⓐ $9x^2-4y^2$

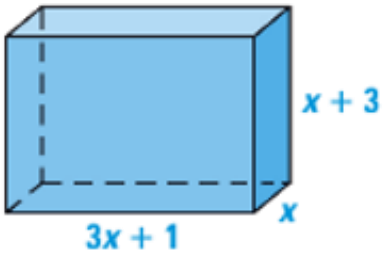
Ⓑ $9x^2+4y^2$

Ⓒ $9x^2+12xy+4y^2$

Ⓓ $9x^2-12xy+4y^2$

10. Write the figure's volume as a polynomial in standard form.

$V = \ell wh$



$3x^3+10x^2+3x$

Algebra 2
Unit 6 – Day 6 – Factor and Solve Polynomial Equations

Name:_____
Period:_____Date:_____

Factor the polynomials completely.

1. $14x^2 - 21x$ $\quad 7x(2x-3)$

2. $c^3 + 9c^2 + 18c$ $\quad c(c+3)(c+6)$

Sum or Difference of Cubes – Factor the polynomials completely

3. $y^3 - 64$ $\quad (y-4)(y^2+4y+16)$

4. $-5z^3 + 320$ $\quad -5(z-4)(z^2+4z+16)$

Factoring by Grouping – Factor the polynomials completely.

5. $y^3 - 7y^2 + 4y - 28$ $\quad (y-7)(y^2+4)$

6. $3m^3 - m^2 + 9m - 3$ $\quad (3m-1)(m^2+3)$

Quadratic Form – Factor the polynomials completely.

7. $x^4 - 25$ $\quad (x^2+5)(x-\sqrt{5})(x+\sqrt{5})$

8. $a^4 + 7a^2 + 6$ $\quad (a^2+1)(a^2+6)$

Solve to find the real-number solutions of the equations.

9. $y^3 - 5y^2 = 0$

$x = 0$

$x = 5$

10. $g^3 + 3g^2 - g = 3$

$g = -3$

$g = -1$

$g = 1$

11. $m^3 + 6m^2 - 4m - 24 = 0$

$m = -6$

$m = -2$

$m = 2$

12. $4w^4 + 40w^2 - 44 = 0$

$w = -1$

$w = 1$

Algebra 2 – 2020 Name:_____

Unit 6 – Unit Review Period:_____Date:_____

For 1 – 2, use synthetic substitution to evaluate the function.

1. $f(x) = 7x^3 + 3x^2 - 7x + 3$; when $x = 3$

198

2. $f(x) = 8x^3 - 2x^2 - 3x - 5$; $f(5)$

930

For 3 – 4, find the end behavior of each function.

3. $f(x) = -x^3 + 7x + 4$

$f(x) \to$ $+\infty$ $as\ x \to -\infty$, $f(x) \to$ $-\infty$ $as\ x \to \infty$

4. $f(x) = 3x^4 - x^2 + 4$

$f(x) \to$ $+\infty$ $as\ x \to -\infty$, $f(x) \to$ $+\infty$ $as\ x \to \infty$

For 5 – 6, decide whether the function is polynomial function. If so, state its degree, type, number of terms, and the leading coefficient.

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

Polynomial Function: *Yes*

Degree: 3

Type: *Cubic*

Leading Coefficient: 2

Number of terms: 3

6. $f(x) = x^4 - x^2 + 3^x - 7$

Polynomial Function: *NO*

Degree: _____

Type: _____

Leading Coefficient: _____

Number of terms: _____

For 7 – 9, find the sum or difference.

7. $(6q^5 + 8q^2 + 3) + (8q^5 - 3q^2 - 7)$

$14q^5 + 5q^2 - 4$

8. $(3x + 7) - (5x^2 - 6x + 2)$

$-5x^2 + 9x + 5$

9. $(-8s^2 - 7s) - (-9s - 1 - 2s^2)$

$-6s^2 + 2s + 1$

For 10 – 12, find the product.

10. $(u + 4)(u^2 - 3u + 3)$

$u^3 + u^2 - 9u + 12$

11. $(x - 3)(x^2 + 4x + 5)$

$x^3 + x^2 - 7x - 15$

12. $(2x - 1)^3$

$8x^3 - 12x^2 + 6x - 1$

For 13 – 17, factor the following polynomials completely.

13. $n^5 + 216n^2$

$n^2(n+6)(n^2-6x+36)$

14. $2z^8 - 6z^6 - 80z^4$

$2z^4(z-2\sqrt{2})(z+2\sqrt{2})(z^2+5)$

15. $4x^3 - 8x^2 + 3x - 6$

$(4x^2+3)(x-2)$

16. $x^8 - 81$

$(x^4+9)(x^2+3)(x+\sqrt{3})(x-\sqrt{3})$

17. $64x^3 - 27y^3$

$(4x-3y)(16x^2+12xy+9y^2)$

For 18 – 21, find the real number solution for each equation.

18. $x^4 + 5 = 6x^2$

$x = \pm\sqrt{5}$

$x = \pm 1$

19. $x^3 + 3x^2 = 28x$

$x = -7$

$x = 0$

$x = 4$

20. $x^3 + 2 = 2x^2 + x$

$x = -1$

$x = 1$

$x = 2$

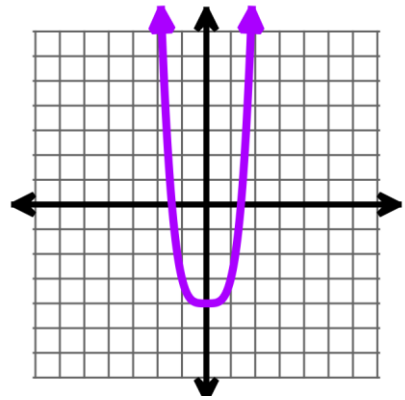
21. $36y^3 + 48y^2 + 16y = 0$

$y = \pm\frac{2}{3}$

$y = 0$

For 22 – graph the function, find any local mins or maxs, then fill out the table to the right.

22. $y = x^4 - 4$

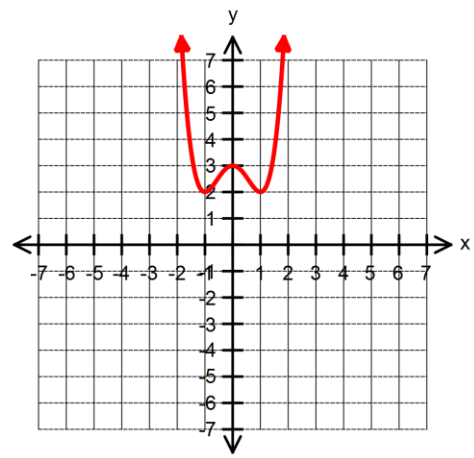


Mins: $(0,-4)$

Max: *None*

x	-3	-2	-1	0	1	2	3
$f(x)$	72	12	-3	-4	-3	12	77

23. Given the graph to the right, approximate the following:



Min Values: 2 Max Value: 3

Increasing: $(-1,0)U(1,\infty)$ Decreasing: $(-\infty,-1)U(0,1)$

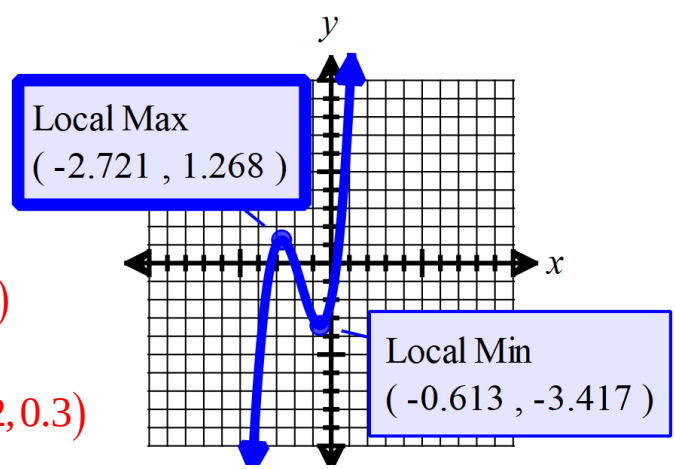
Positive: *ARN* Negative: *None*

End Behavior: $f(x) \to$ $+\infty$ $as\ x \to -\infty$, $f(x) \to$ $+\infty$ $as\ x \to \infty$

Approximate for the following graph.

24. $f(x) = x^3 + 5x^2 + 5x - 2$

x	-3	-2	-1	0	1	2	3
(x)	1	0	-3	-2	9	36	85



Local Mins: $(-0.6,-3.4)$ Local Maxs: $(-2.7,1.3)$

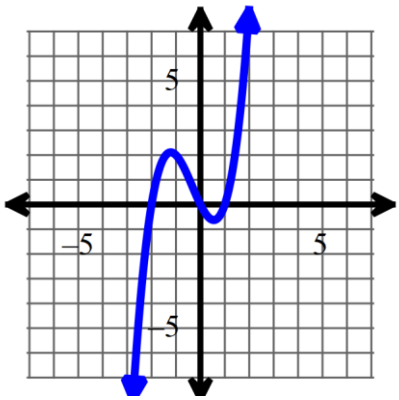
Increasing: $(-\infty,-2.7)U(-0.6,\infty)$ Decreasing: $(-2.7,-0.6)$

Positive: $(-3.3,-2)U(0.3,\infty)$ Negative: $(-\infty,-3.3)U(-2,0.3)$

End Behavior: $f(x) \to$ $-\infty$ $as\ x \to -\infty$, $f(x) \to$ $+\infty$ $as\ x \to \infty$

Multiple Choice Section:

25. The function, $f(x)$, is graphed below. Which of the following statements are true? Select **all** that apply.



A. $f(x)$ is positive on the interval $0 < x < 1$.

B. $f(x)$ is positive on the interval $-2 < x < 0$.

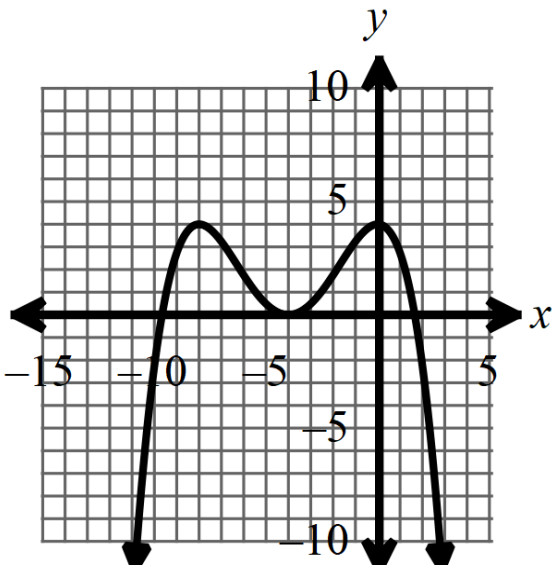
C. $f(x)$ is positive on the interval $x > 1$.

D. $f(x)$ is negative on the interval $-2 < x < 0$ . .

E. $f(x)$ is negative on the interval $x < -2$.

F. $f(x)$ is negative on the intervals $0 < x < 1$

26. State where the function is increasing and decreasing.



A. Increasing: $(-9.657, -4) \cup (-4, 1.657)$
Decreasing: $(-\infty, -9.657) \cup (1.657, +\infty)$

B. Increasing: $(-8, 0) \cup (0, +\infty)$
Decreasing: $(-\infty, -8)$

C. Increasing: $(-\infty, -8) \cup (0, 8)$
Decreasing: $(-8, 0)$

D. Increasing: $(-\infty, -8) \cup (-4, 0)$
Decreasing: $(-8, -4) \cup (0, +\infty)$

27. Which of the following expressions must be subtracted from $(4x^3 - 5x^2 + 6x - 3)$ to result in $(6x^3 - 2x^2 + 4x + 7)$?

A. $-2x^3 - 3x^2 + 2x - 10$

B. $2x^3 + 3x^2 - 2x + 10$

C. $-2x^3 - 7x^2 + 10x + 4$

D. $2x^3 - 7x^2 + 10x + 4$

28. Find the product: $(x-1)(x+5)(x-3)$

A. x^3+15

B. $x^3+x^2-17x+15$

C. $x^3-3x^2-13x-15$

D. $x^3+7x^2-7x+15$

29. Factor completely: x^4-13x^2+36

A. $(x^2-9)(x^2+4)$

B. $(x-3)(x+3)(x+4)(x-4)$

C. $(x-3)(x+3)(x+2)^2$

D. $(x-3)(x+3)(x+2)(x-2)$