Unit 2 Review - Polynomials NAME ______________________________

Polynomial Division

Divide using either long division or synthetic division (when possible).

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

$9x^2 + 25x + 80 + \frac{244}{x-3}$

2. $(6x^3 + 19x^2 + 7x - 12) \div (2x + 3)$.

$3x^2 + 5x - 4$

3. $(12x^3 - 7x^2 - 38x + 35) \div (4x - 5)$

$3x^2 + 2x - 7$

4. $(x^4 + 7x^3 - 6x + 2) \div (x + 4)$

$x^3 + 3x^2 - 12x + 42 - \frac{166}{x+4}$

Remainder/Factor Theorem

Determine which are factors of $2x^{91} - x^{90} - 10x^{89}$.

5. $x - 1$

no

6. $2x - 5$

yes

7. $x + 2$

yes

Polynomial Vocabulary

Classify each polynomial by the degree and by the number of terms.

8. $7x^3 - 2x$

cubic
binomial

9. $-10x^4 - 3x^3 + 2$

quartic
trinomial

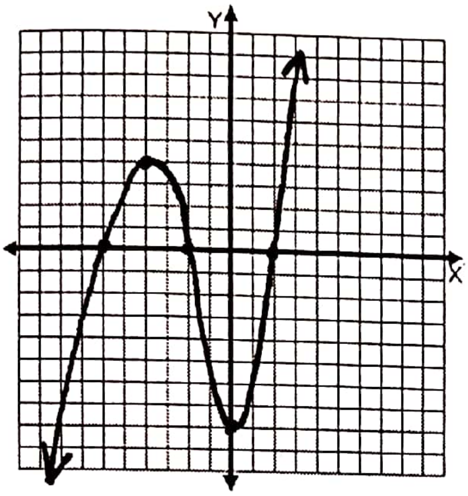
10. 7

constant
monomial

Zeroes and Multiplicity, Extrema, Intervals for Increasing/Decreasing/Positive/Negative

For each graph and equation, determine all key features.

11.



Zeroes: x = -6 m:1, x = -2 m:1, x = 2 m:1

Degree: 3

Extrema: (-4,4) rela max (0,-8) rela min

Pos: (-6,-2) (2,∞)

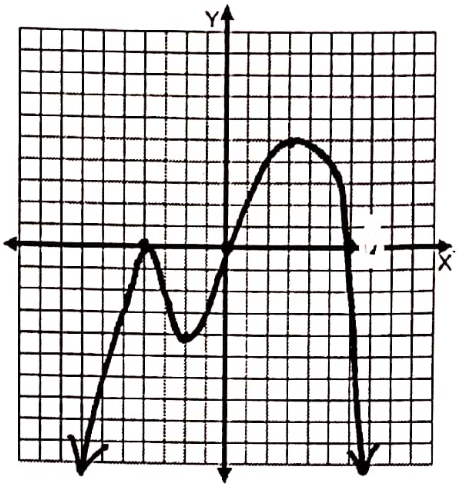
Neg: (-∞,-6) (-2,2)

Inc: (-∞,-4) (0,∞)

Dec: (-4,0)

End Behavior: as x→ -∞, y→ -∞ as x→ ∞, y→∞

12.



Zeroes: x = -4 m:2, x = 0 m:1, x = 6 m:1

Degree: 4

Extrema: (-4,0) rela max (-2,-4) rela min (3,5) abs max

Pos: (0,6)

Neg: (-∞,-4) (-4,0) (6,0)

Inc: (-∞,-4) (-2,3)

Dec: (-4,-2) (3,∞)

End Behavior: as x→ -∞, y→ -∞ as x→∞, y→ -∞

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

Zeroes: x = -1 m:2, x = $\frac{1}{3}$ m:1

Degree: 3

Extrema: (-1,0) rela min (-.11, 2.11) rela max

Pos: (-∞,-1) (-1, $\frac{1}{3}$)

Neg: ($\frac{1}{3}$, ∞)

Inc: (-1, -.11)

Dec: (-∞,-1) (-.11, ∞)

End Behavior: as x→ -∞, y→ ∞ as x→ ∞, y→ -∞

14. $y = x^3(x-2)(x-3)$

Zeroes: x = 0 m:3, x = 2 m:1, x = 3 m:1

Degree: 5

Extrema: (1.37, 2.64) rela max (2.63, -4.24) rela min

Pos: (0,2) (3,∞)

Neg: (-∞,0) (2,3)

Inc: (-∞, 1.37) (2.63, ∞)

Dec: (1.37, 2.63)

End Behavior: as x→ -∞, y→ -∞ as x→∞, y→∞

Solve Polynomials

Determine all real and complex solutions.

15. $x^3 - 5x^2 + 3x - 15 = 0$

$X = 5, \pm i\sqrt{3}$

16. $x^4 - 3x^3 - 24x^2 + 80x = 0$

$X = -5, 0, 4, 4$

17. $x^3 + 64 = 0$

$X = -4, 2 \pm 2i\sqrt{3}$

18. $x^3 + 5x^2 + 10x + 24 = 0$

$X = -4, \frac{-1 \pm i\sqrt{23}}{2}$

Applications

19. The weight of an ideal round-cut diamond can be modeled by $w = 0.0074d^3 - 0.087d^2 + 0.32d$, where w is the diamond's weight (in carats) and d is its diameter (in millimeters). According to the model, what is the weight of a diamond with a diameter of 12 millimeters?

4.0992 carats

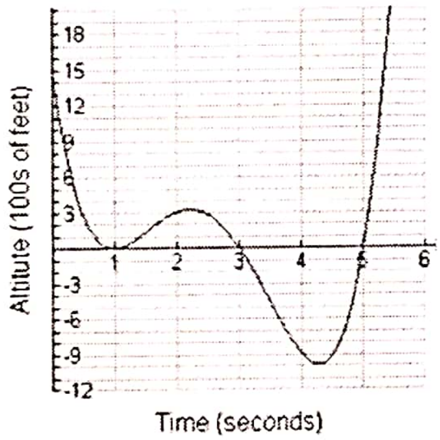
20. The profit P (in millions of dollars) for a t-shirt manufacturer can be modeled by $P = -x^3 + 5x^2 + 9x$, where x is the number of t-shirts produced (in millions). Currently, the company produces 5 million t-shirts and makes a profit of $45,000,000. What lesser number of t-shirts could the company produce and still make the same profit?

3 million t-shirts

21. A box has a height of $x-4$ inches and a length of $x+3$ inches. If the volume of the box is $2x^3-3x^2-23x+12$ cubic inches, determine the width of the box.

$2x-1$

22. When fighter pilots train for dog-fighting, a "hard-deck" is usually established below which no competitive activity can take place. The polynomial graph given shows Maverick's altitude (y in 100s of feet) above and below this hard-deck during a 5 second (x) interval.



a. What is the lowest possible degree of this polynomial?

4

b. How many total seconds was Maverick above the hard-deck during the first 5 seconds?

3 seconds

c. After how many seconds is Maverick 300 feet above the hard-deck?

3.5 seconds

d. Determine the equation of the function in factored form.

$(x-1)^2(x-3)(x-5)$

Rates of Change

23. Find the average rate of change from ***x* = – 1** to ***x* = 3** for each of the functions below.

a. $a(x)=2x+3$

2

b. $b(x)=x^2-2$

2

c. $c(x)=2^x-1$

1.875

d. Which function has the greatest average rate of change over the interval **[– 1, 3]**?

a(x) and b(x)

24. In general as $x\to\infty$, which function eventually grows at the fastest rate?

a. $a(x)=3x$

b. $b(x)=x^3$

c. $c(x)=3^x$

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