Unit 3 "Bare Necessities" - Polynomials/Quadratics

Operations with Polynomials

To add or subtract polynomials: Identify like terms and combine coefficients (do not change exponents!!)

To multiply polynomials: Distribute as needed. Multiply coefficients and add exponents. Identify and combine like terms.

1) $(7n^4 + 6n^3 + 2n) + (8n^4 - n^3 + 5n)$

$15n^4 + 5n^3 + 7n$

2) $(p^4 - 8p - 4p^3) - (-7p^4 - 5p^3 + 7p)$

$8p^4 + p^3 - 15p$

3) $(3k + 7)^2$

$9k^2 + 42k + 49$

4) $(6x + 3)(2x + 5)$

$12x^2 + 36x + 15$

5) $(f + 3)(f^2 + 2f - 6)$

$f^3 + 5f^2 - 18$

6) $5xy^2(4x^2y + 8xy - 2y)$

$20x^3y^3 + 40x^2y^3 - 10xy^3$

Applications of Polynomials

7) The number of dinosaurs in Jurassic World is modeled by $6x^2 + 3x + 130$. The Indominus Rex gets out and kills $2x^2 + x - 54$ dinosaurs before it is stopped. How many dinosaurs are still alive?

$4x^2 + 2x + 184$

8) A rectangular velociraptor paddock has a length of $6x + 2$ feet and width of $3x - 3$ feet.

a. Determine the perimeter of the paddock.

$18x - 2$

b. Determine the area of the paddock.

$18x^2 - 12x - 6$

9) The lengths of two sides of a triangular stegosaurus feeding trough are given by $5x^2 + 3x - 4$ and $7x + 3$. The perimeter of the feeding trough is $11x^2 + 7x + 3$. Find the length of the missing side.

$6x^2 - 3x + 4$

10) A rectangular tyrannosaurus rex paddock has an area of $x^3 + x^2 - 11x + 4$ square meters, and a width of $x + 4$ meters. Find its length.

$x^2 - 3x + 1$

Synthetic Division

Make sure exponents are in descending order.

11) $(3x^2 + 4x - 12) \div (x + 5)$

$3x - 11 + \frac{43}{x+5}$

12) $(x^2 - 5x - 12) \div (x - 3)$

$x - 2 - \frac{18}{x-3}$

13) $(x^4 - 3x^2 + 2x + 12) \div (x + 1)$

$x^3 - x^2 - 2x + 4 + \frac{8}{x+1}$

14) $(2x^3 + 3x^2 - 8x + 3) \div (x + 4)$

$2x^2 - 5x + 12 - \frac{45}{x+4}$

Find Vertex

Find x-coordinate using the formula $x = \frac{-b}{2a}$, substitute in x-coordinate to find y-coordinate

15) $y = x^2 + 16x + 64$

$(-8, 0)$

16) $y = 2x^2 - 4x - 2$

$(1, -4)$

17) $y = -3x^2 + 12x - 10$

$(2, 2)$

Simplifying Radicals

Use prime factorization. Take numbers out in "groups" that match the index. Don't forget imaginary numbers.

18) $\sqrt{-60}$

$2i\sqrt{15}$

19) $\sqrt{-300}$

$10i\sqrt{3}$

20) $\sqrt{-90}$

$3i\sqrt{10}$

actoring

1. Factor out GCF
2. How many terms?
   a. 2 terms
      i. factoring using difference of squares
      ii. factoring using sum or difference of cubes
   b. 3 terms
      i. factor using "bottom up" method (or any other method for trinomials)
   c. 4 terms
      i. factor by grouping

21) $4x^4 - 16$

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

22) $6y^2 - y - 12$

$(3y+4)(2y-3)$

23) $21w^3 - 35w$

$7w(3w^2-5)$

24) $6n^3 - 8n^2 + 18n - 24$

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

25) $x^2 - x - 56$

$(x-8)(x+7)$

26) $h^3 + 8$

$(h+2)(h^2-2h+4)$

27) $x^3 - 5x^2 - 9x + 45$

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

28) $27k^3 - 1$

$(3k-1)(9k^2+3k+1)$

29) $2g^3 - 10g^2 - 72g$

$2g(g+4)(g-9)$

Solving Quadratic Equations

$ax^2 + bx + c = 0$

**must be equal to zero

**helpful if a is positive

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

30) $m^2 - 5m - 14 = 0$

$m = 7, -2$

31) $2x^2 - 3x - 5 = 0$

$x = \frac{5}{2}, -1$

32) $2k^2 - 7k - 13 = -10$

$k = \frac{7 \pm \sqrt{73}}{4}$

33) $8a^2 + 6a = -5$

$a = \frac{-3 \pm i\sqrt{31}}{8}$

34) $8n^2 - 18 = 4n$

$n = \frac{1 \pm \sqrt{37}}{4}$

35) $2h^2 = -4h - 3$

$h = \frac{-2 \pm i\sqrt{2}}{2}$

Quadratics

et is launched upward from ground level. Its height h after t seconds is given by the equation
$-128t$.

What height is rocket after 3 seconds?

240 ft

b. When will the rocket hit ground?

8 sec

37) The number of new cars purchased in a city is modeled by the equation $C = 25t^2 + 178t + 3180$, where C is the number of new cars and $t = 0$ corresponds to the number of new cars purchased in 1960.

a. How many cars were purchased in 1973?

9719 cars

b. In what year will the number of new cars reach 25,000?

1986

38) A company makes and sells swing sets. The equation $P = -0.5x^2 + 176x - 1440$ can be used to model the company's monthly net profit, P, where x is the price the company charges per swing set. What price should the company charge to make the maximum profit?

$176

End Behavior/Zeros of Polynomials

1. Use calculator to graph and find ONE zero. (You may have to repeat this step for higher degree polynomials.)
2. Use synthetic division to find other polynomial factor.
3. Find zeroes by using quadratic formula/factoring.

39) $f(x) = 3x^4 - 19x^3 + 3x^2 + 91x - 30$

↑ | ↑ $x = -2, 3, 5, \frac{1}{3}$

40) $f(x) = 2x^3 - 8x^2 + 8x - 32$

| ↑ $x = 2i, -2i, 4$
↓

41). $f(x) = -2x^4 + 5x^3 - 7x^2 + 10x - 6$

| | $x = 1, \frac{3}{2}, i\sqrt{2}, -i\sqrt{2}$
↓ ↓

42) $f(x) = -6x^5 - 25x^4 + 76x^3 + 60x^2$

↑ | $x = 0, 0, \frac{5}{2}, -6, -\frac{2}{3}$
↓

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