Warm-up:

1) Is (x + 4) a factor of $x^2 + 7x + 12$?

yes $(x+4)(x+3)$

2) Factor $3x^2 - 27$

$3(x^2 - 9) = 3(x+3)(x-9)$

$x = x \quad y = 3$

3) Factor $5x^2 + 50x + 125$

$5(x^2 + 10x + 25)$

$5(x+5)(x+5) = 5(x+5)^2$

25, 5, 5, 10

4) Factor $6x^2 + x - 2$

-12

$6 \cdot 2$

$3 \cdot 4$

12

$((6x^2 + 4x)(-3x - 2)$

$2x(3x+2) - 1(3x+2)$

$(2x-1)(3x+2)$

ACT of the day

5. If $f(x) = (3x + 7)^2$, then $f(1) = ?$

A. 10
B. 16
C. 58
D. 79
E. 100

$f(1) = (3(1) + 7)^2$

$(3 + 7)^2$

$(10)^2 = 100$

Unit 1 ~ Polynomials

Standard

Objective: A.SSE.2

Day 4:

Factoring Sums & Differences of Cubes

Formulas:

Sum of cubes

$$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

a, b are #'s

Difference of cubes

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

to find the values of 'a' and 'b' you take the $\sqrt[3]{}$ of a^3 and b^3

Example 1:

Factor $x^3 + 8$.

1. $a = \sqrt[3]{x^3} = \sqrt[3]{(x \cdot x \cdot x)} = x$
   $b = \sqrt[3]{8} = 2$
   $a = x \quad b = 2$
2. $(a^3+b^3) = (a+b)(a^2-ab+b^2)$
3. $(x+2)(x)^2-(2 \cdot x)+2^2)$

$(x^3+8) = \boxed{(x+2)(x^2-2x+4)}$

Steps

1. $\sqrt[3]{a^3}$ and $\sqrt[3]{b^3}$
2. Determine the formula to use
3. plug values of 'a' and 'b' into the formula.

Example 2:

Factor $27x^3 - 1$

$a^3 \qquad b^3$

1. $a = \sqrt[3]{27x^3} = 3x \qquad b = \sqrt[3]{1} = 1$
   $a = 3x \qquad b = 1$
2. $(a^3-b^3) = (a-b)(a^2+ab+b^2)$
   $a = 3x \quad b = 1$
3. $(3x-1)((3x)^2 + 3x \cdot 1 + 1^2)$

$\boxed{(3x-1)(9x^2+3x+1)}$

$(3x)^2 = 3^2 x^2 = 9x^2$

Example 3:

Factor $2x^4 - 54x$

$2x(x^3 - 27)$

1. $a = \sqrt[3]{x^3} \qquad b = \sqrt[3]{27}$
   $a = x \quad b = 3$
2. $(a^3-b^3) = (a-b)(a^2+ab+b^2)$
3. $\boxed{(x-3)(x^2+3x+9)}$ ← ANSWER

Your Turn:

1) Factor $2x^3 + 250$

$2(x^3 + 125)$

$a = \sqrt[3]{x^3} = x \qquad b = \sqrt[3]{125} = 5 \qquad a = x \quad b = 5$

$(a^3+b^3) = (a+b)(a^2-ab+b^2)$

$(x+5)((x)^2 - x \cdot 5 + (5)^2)$

$\boxed{2(x+5)(x^2-5x+25)}$

2) Factor $3x^4 - 1536x$

$3x(x^3 - 8^3)$

$3x((x-8(x^2+(x)(8)+8^2))$

$3x(x-8)(x^2+x\,8+64)$

Example 4:

Factor $64x^3 - 27y^3$

1. $a = \sqrt[3]{64x^3} = 4x$ $\quad b = \sqrt[3]{27y^3} = 3y$

   $a = 4x \quad b = 3y$

2. $(a-b)(a^2+ab+b^2)$

   $(4x-3y)((4x)^2 + 3x\cdot 4x + (3y)^2)$

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

$(4x)^2 = 4^2 \cdot x^2 = 16x^2$

$(3y)^2 = 3^2 x^2 = 9x^2$

Your Turn:

Factor $x^6y^9 + 8$

sum of cubes

$a = \sqrt[3]{x^6y^9} = \sqrt{xxxxxx\,yyyyyyyyy} = x^2y^3$

$b = \sqrt[3]{8} = 2$

$a^2 = (x^2y^3)^2 = x^{2\cdot 2}y^{3\cdot 2} = x^4y^6$

$a\cdot b \quad (x^2y^3)(2) = 2x^2y^3$

$b^2 = 2^2 = 4$

$(a^3+b^3) = (a+b)(a^2-ab+b^2)$

$(x^6y^9+8) = (x^2y^3+2)(x^4y^6-2x^2y^3+4)$

Independent Practice