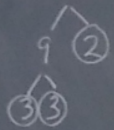
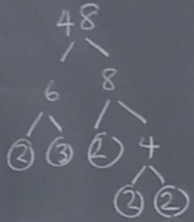
Prime Factorization "Factor trees"

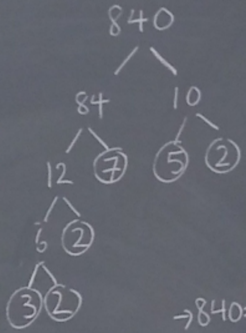
Factor 18



$\rightarrow 18 = 3^2 \cdot 2$



$48 = 2^4 \cdot 3$



$\rightarrow 840 = 2^3 \cdot 3 \cdot 5 \cdot 7$

Fundamental Theorem of Arithmetic

- Every nonzero integer can be written as a unique set of prime factors.

Divisibility Rules

Divisible by 2. - even number
- ends in 2, 4, 6, 8, 0

3 - 1. Add all digits
2. If sum of all digits is divisible by 3, then original number is divisible by 3.

4 - last two digits are divisible by 4.

5 - ends in 5 or 0.

6 - follows rules for 2 and 3.

8 - last 3 digits divisible by 8.

9 - same rules as 3. except sum is divisible by 9.

10 - ends in 0

100 - ends in 00

1000 - ends in 000

$$\begin{array}{r} 894 \\ 3\overline{)2682} \\ -24 \\ \hline 28 \\ -27 \\ \hline 12 \\ -12 \\ \hline 0 \end{array}$$

1. $2+6+8+2=18$

→ 18 is divisible by 3

→ 2682 divisible by 3?

$2682 \div 3 = 894$

→ divisible by 2, 3, 6, 9

12 - rules for 4 and 3 or rules for 2 and 6.

25 - ends in 25, 50, 75, or 00.

Division of Monomials

Recall additon and subtraction of fractions

$$\frac{5x}{3} + \frac{2}{3} = \frac{5x+2}{3}$$

add numerators
keep denominators
(only if common denominator)

$$\frac{5x}{3} + \frac{2}{7} \neq \frac{5x+2}{21}$$

Do not do this

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

If asked to divide $\frac{a+b}{c}$

Divide $\frac{5x+2}{3} = \frac{5x}{3} + \frac{2}{3}$

divide all terms in numerator by the denominator separately.

Recall

$$3x - 2y = 8$$
$$-3x \qquad -3x$$
$$-2y = -3x + 8$$
$$\frac{-2y}{-2} = \frac{-3x+8}{-2}$$

$$y = \frac{-3x+8}{-2}$$

Divide both terms by the denominator.

$$y = \frac{-3x}{-2} + \frac{8}{-2}$$

$$y = \frac{3}{2}x + (-4)$$

$$y = \frac{3}{2}x - 4$$

Divide

$$\frac{6x^5-15x^3+9x^2-3x}{3x}$$

$$\frac{6x^5}{3x}-\frac{15x^3}{3x}+\frac{9x^2}{3x}-\frac{3x}{3x}$$

$$\frac{6}{3}x^{5-1}-\frac{15}{3}x^{3-1}+\frac{9}{3}x^{2-1}-1$$

$$2x^4-5x^2+3x-1$$

L

$$\frac{24y^5-21y^2}{-3y}$$

$$-8y^4+7y$$

$$\frac{24y^5}{-3y}-\frac{21y^2}{-3y}$$

$$-8y^4+7y$$

$$\frac{-35b^4+5b^2}{5b^2}$$

$$-\frac{35b^4}{5b^2}+\frac{5b^2}{5b^2}$$

$$-7b^2+1b$$

$$\boxed{-7b^2+1}$$

GCF - Greatest common factor

What is GCF of 24 and 12?

$24 = 2^3 \cdot 3$

24
6 4
3 2 2 2

$12 = 2^2 \cdot 3$

12
4 3
2 2

$24 = 2 \cdot 2 \cdot 2 \cdot 3$
$12 = 2 \cdot 2 \cdot 3$

GCF = multiply all shared factors

$2 \cdot 2 \cdot 3 = 12$

GCF of 2 and 3?

GCF is 1.

GCF of a, b = 1

GCF of x^2 and $x^3 = x^2$

$x^2 = x \cdot x$
$x^3 = x \cdot x \cdot x$

GCF = $x \cdot x = x^2$

GCF of ab and ac = a

Factor by GCF

$9x^4 + 18x^3 - 6x^2$

1. Identify GCF of all terms

$9x^4 = 3 \cdot 3 \cdot x \cdot x \cdot x \cdot x$

$18x^3 = 2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x$

$6x^2 = 2 \cdot 3 \cdot x \cdot x$

GCF = $3 \quad x^2$

2. Pull out GCF, divide original expression by GCF

$$3x^2\left(\frac{9x^4 + 18x^3 - 6x^2}{3x^2}\right)$$

$$3x^2\left(\frac{9x^4}{3x^2} + \frac{18x^3}{3x^2} - \frac{6x^2}{3x^2}\right)$$

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

Check by multiplying

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

$$9x^4 + 18x^3 - 6x^2$$

Factor

$8x^4 - 4x^3 + 16x^2 - 4x + 24$

$4\left(\frac{8x^4}{4} \quad \frac{-4x^3}{4} \quad \frac{16x^2}{4} \quad \frac{-4x}{4} \quad \frac{24}{4}\right)$

$4(2x^4 - 1x^3 + 4x^2 - 1x + 6)$

$9a^3b^4 - 3a^2b^3 + 6ab^2$

GCF: $3ab^2$

lowest powers of a and b in expression

GCF of 3, 9, 6

$3ab^2\left(\frac{9a^3b^4}{3ab^2} - \frac{3a^2b^3}{3ab^2} + \frac{6ab^2}{3ab^2}\right)$

$3ab^2(3a^2b^2 - 1ab + 2)$

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$$18x^3 = 2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x$$
$$6x^2 = 2 \cdot 3 \cdot x \cdot x$$

$$GCF = 3 \quad x^2$$

2. Pull out GCF, divide original expression by GCF

$$3x^2\left(\frac{9x^4 + 18x^3 - 6x^2}{3x^2}\right)$$

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

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$$9x^4 + 18x^3 - 6x^2$$