Unit 1: Lesson 03

Review of sign rules for arithmetic operations
Unit multipliers

Rules for addition and subtraction:

If signs are alike: Add the two numbers and apply their sign.

Example group 1:

3 + (+4) = *+7*

(-5) – 4 = *-9*

5 + 8 = *+13*

-4 + (-6) = *-10*

-9 –2 = *-11*

If signs are different: Subtract and give the answer the sign of the largest number.

Examples group 2:

3 + (-7) = *-4*

14 – 8 = *6*

9 – 11 = *-2*

22 + (-1) = *21*

Rules for multiplication:

If signs are alike: Multiply and give the answer a positive sign.

Example group 3:

3(4) = *12*

-3(-12) = *36*

(-5)(-3) = *15*

If signs are different: Multiply and give the answer a negative sign.

Example group 4:

(-3)4 = *-12*

5(-2) = *-10*

Rules for division (same as for multiplication):

If signs are alike: Divide and give the answer a positive sign.

Example group 5:

12 / (4) = 3 -12 / (-3) = 4

6 / 2 = 3 (-15) / (-3) = 5

If signs are different: Divide and give the answer a negative sign.

Example group 6:

(-30) / 5 = -6 -8 / 2 = -4

16 / (-2) = -8

Unit multipliers:

Now consider the various ways in which we could express 1 as any number over itself. For example:

$\frac{189}{189} = 1$, $\frac{\pi}{\pi} = 1$, etc.

Consider an unusual way in which we could multiply by 1. Since 12 inches = 1 foot, when we "stack" them as follows, the quotient is exactly 1:

$\frac{12\,in}{1\,ft} = 1$ or $\frac{1\,ft}{12\,in} = 1$

Some other ways to "build *1*" are:

$\frac{2\,pints}{1\,quart}$, $\frac{1\,yd}{36''}$, $\frac{100\,cm}{1\,meter}$

These quantities that are equivalent to *1* are known as **unit multipliers**. They are useful in converting a number expressed in one type of units to an **equivalent number of different types of units**. . .for example, from inches to yards.

Example 7: Convert 108.19 inches to yards.

$$\frac{108.19\ \text{in}}{1}\cdot\frac{1\ \text{yd}}{36\ \text{in}} = \frac{108.19}{36}\ \text{yd}$$

$$= \boxed{3.00527\ \text{yd}}$$

Example 8: Convert 22.8 feet into inches.

$$\frac{22.8\ \text{ft}}{1}\cdot\frac{12\ \text{in}}{1\ \text{ft}} = 22.8(12)\ \text{in}$$

$$= \boxed{273.6\ \text{in}}$$

Example 9: Convert 450 cm into meters.

$$\frac{450\ \text{cm}}{1}\cdot\frac{1\ \text{m}}{100\ \text{cm}} = \frac{450\ \text{m}}{100}$$

$$= \boxed{4.5\ \text{m}}$$

Example 10: Use the fact that 1 inch = 2.54 cm to convert 19 cm into inches.

$$\frac{19\ \text{cm}}{1}\cdot\frac{1\ \text{in}}{2.54\ \text{cm}} = \frac{19}{2.54}\ \text{in}$$

$$= \boxed{7.4803\ \text{in}}$$

Multiple applications of unit multipliers:

It is possible to apply **more than one unit multiplier in succession** in order to achieve the desired conversion.

***Example 11:** Convert 150 meters into inches.

$$\frac{150\ \text{m}}{1}\ \frac{100\ \text{cm}}{1\ \text{m}} = 15{,}000\ \text{cm}\ \frac{1\ \text{in}}{2.54\ \text{cm}}$$

$$= \frac{15{,}000}{2.54}\ \text{in}$$

$$= \boxed{5{,}905.5118\ \text{in}}$$

Assignment:

1. 5(-3) =	**2.** 8(5) =	**3.** -9/(-3) =
4. -2(-6) **=**	**5.** 22(-1) =	**6.** -12(-2) =
7. 3 + (-8) =	**8.** (-50)/10 =	**9.** 2 + (19) =
10. 16(2) =	**11.** 23 + (-2) =	**12.** -8/4 =
13. 15 – 6 =	**14.** 16/(-2) =	**15.** 36/4 =
16. (-3)(-8) =	**17.** 5(-4) =	**18.** -3(-22) =
19. 9 – 12 =	**20.** 5 + (8) =	**21.** -6 + (-7) =
22. 8 + (-11) =	**23.** (-2) – 4 =	**24.** -19(-2) =
***25.** (400 – 20)/(-10) =	***26.** -4 + (-2)(-6) =	***27.** (-5)(-4)(-3) =

28. Use a unit multiplier to convert 24.1 quarts to pints (1 quart = 2 pints).

29. Use a unit multiplier to convert 80.9 millimeters to meters (1000 mm = 1 m).

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30. Use a unit multiplier to convert 11.28 inches to centimeters (2.54 cm = 1 in).

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31. Use a unit multiplier to convert 102 centimeters to inches.

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32. Use a unit multiplier to convert 82,000 feet to miles (5280 ft = 1 mi).

***33.** Use multiple unit multipliers to convert 82,000 inches to meters.