$\left(\frac{7}{a}\right)a = 7$ $\left(\frac{mi}{hr}\right)hr = mi$

$\left(\frac{15}{4}\right)4 = 15$ "per" means "divided by"

Working with formulas

Example 1

The formula $D = rt$ can be used to determine the distance traveled, D, when an object moves at a constant speed, r, for a length of time t.

Determine how far you drive if you drive at a constant speed of $62\,\text{mph}$ for $2\frac{1}{2}\,\text{hr}$.

$r = 62\frac{mi}{hr}$, $t = 2.5\,hr$ $\quad D = rt$

$D = \left(62\frac{mi}{hr}\right)(2.5\,hr)$

$= 155\,mi$

I drive 155 miles.

Include units while making calculations

$\frac{14}{7} = 2\frac{5}{7}$

Determine the speed at which a Joaquin was walking (ft/sec) if he walked at a constant speed for 5 minutes and trekked 1020 feet during those 5 minutes.

$t = 5\,\text{minutes} = 300\,s$

$D = 1020\,ft$

$D = rt$

$1020\,ft = r(300\,s)$

$\frac{1020\,ft}{300\,s} = \frac{r(300\,s)}{300\,s}$

$3.4\frac{ft}{s} = r$

Joaquin was walking at 3.4 ft/s.

Include units while making calculations

Solve the formula $D = rt$ for t.

$D = rt$

$\frac{D}{r} = \frac{rt}{r}$

$\frac{D}{r} = t$

Example 2

The formula $A = \frac{1}{2}bh$ can be used to determine the area of a triangle, A, whose base is a length of b and height is a length of h.

Find the area of the triangle in Figure 1.

Include units while making calculations

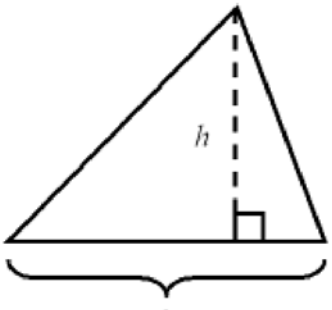

Figure 1

$h = 4.2\,\text{ft}$

$b = 7.1\,\text{ft}$

$A = \frac{1}{2}bh$

$= \frac{1}{2}(7.1\,ft)(4.2\,ft)$

$= 14.91\,ft^2$ The area of the triangle is $14.91\,ft^2$.

↳ read aloud as Square feet

$XX = X^2$ $\quad YY = Y^2$ $\quad (ft)(ft) = ft^2$

$\frac{7^2}{7} = 7$ $\quad \frac{cm^2}{cm} = cm$

$\frac{4^2}{4} = \frac{4 \times 4}{4} = 4 \quad \left(\frac{4}{4}\right)^2$

$\frac{3^2}{3} = 3$

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(2) Find the height of the triangle in Figure 2 if you know that the triangle's area is $65\,\text{cm}^2$; round the height to the nearest 100th.

Include units while making calculations

$A = 65\,cm^2, \quad b = 17\,cm$

$h = \frac{2A}{b}$

$= \frac{2(65\,cm^2)}{17\,cm}$

$\approx 7.65\,cm$

The height is about 7.65cm

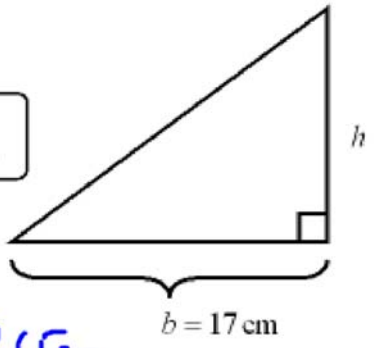

Figure 2

$\frac{cm \cdot cm}{cm}$.

(1) Solve the formula $A = \frac{1}{2}bh$ for the variable h.

$A = \frac{1}{2}bh$

$2(A) = 2\left(\frac{1}{2}bh\right)$

$2A = bh$

$\frac{2A}{b} = \frac{bh}{b}$

$\frac{2A}{b} = h$

Example 3

The formula $V = \pi r^2 h$ can be used to find the volume of a right circular cylinder (which is math speak for a "can.")

A typical soda can holds $355\,\text{ml}$ of soda which is equivalent to $355\,\text{cm}^3$. Assume that a soda can is a perfect cylinder and that its radius is exactly $3.13\,\text{cm}$. What is the height of the can? Round the height to the nearest 100th.

Include units while making calculations

$\frac{2^3}{2^2} = 2$

$\frac{3^3}{3^2} = 3$

$\frac{cm^3}{cm^2} = cm$

Figure 3
An example of the sort of thing you can find for sale on ebay

$V = \pi r^2 h$

$\frac{V}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$

$\frac{V}{\pi r^2} = h$

$V = 355\,cm^3, \quad r = 3.13\,cm$

$h = \frac{V}{\pi r^2}$

$= \frac{355\,cm^3}{\pi(3.13\,cm)^2}$

$= \frac{355}{\pi(3.13)^2}\,\frac{cm^3}{cm^2}$

$\approx 11.53\,cm$

The height of the can is about 11.53cm.

355 cubic centimeters

$b^2 = bb$

b_2 ← name is "b sub 2"

Example 4

The formula for the area of a trapezoid (see Figure 4) is $A = \frac{1}{2}(b_1 + b_2)h$. Solve the formula for the variable b_1.

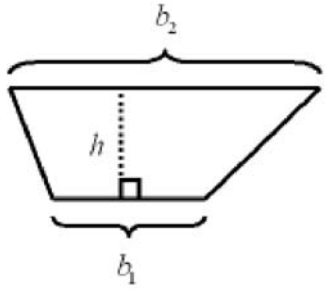

Figure 4
A trapezoid is a 4 sided figure where at least one pair of sides is parallel. The lengths of the two parallel sides are called b_1 and b_2; the distance between these 2 sides is called h.

$A = \frac{1}{2}(b_1 + b_2)h$

$2(A) = 2\left(\frac{1}{2}(b_1 + b_2)h\right)$

$2A = (b_1 + b_2)h$

$2A = b_1 h + b_2 h$

$2A - b_2 h = b_1 h + b_2 h - b_2 h$

$2A - b_2 h = b_1 h$

$\frac{2A - b_2 h}{h} = \frac{b_1 h}{h}$ | $\frac{2A - b_2 h}{h} = b_1$ Done

Example 4 (continued)

The formula for the area of a trapezoid is $A = \frac{1}{2}(b_1 + b_2)h$. Solve the formula for h.

$A = \frac{1}{2}(b_1 + b_2)h$

$2(A) = 2\left[\frac{1}{2}(b_1 + b_2)h\right]$

$2A = (b_1 + b_2)h$

$\frac{2A}{b_1 + b_2} = \frac{(b_1 + b_2)h}{b_1 + b_2}$

$\frac{2A}{b_1 + b_2} = h$

$12 = 5h + 29$

$-17 = 5h$

Example 5

The surface area of a right circular cylinder is given by the formula $S = 2\pi r h + 2\pi r^2$. Solve the formula for h.

$S = 2\pi r h + 2\pi r^2$

$S - 2\pi r^2 = 2\pi r h + 2\pi r^2 - 2\pi r^2$

$S - 2\pi r^2 = 2\pi r h$

$\frac{S - 2\pi r^2}{2\pi r} = \frac{2\pi r h}{2\pi r}$

$\frac{S - 2\pi r^2}{2\pi r} = h$

Percentage change problems

Example 6

In the summer of 2008 the average price of a gallon of regular gasoline jumped from \$2.50 to \$4.00 and then fell again to \$2.50. What was the percentage increase when the priced jumped from \$2.50 to \$4.00 and what was the percentage decrease when the price fell from \$4.00 to \$2.50?

From \$2.50 to \$4.00, the amount of increase is \$1.50

\$1.50 is what percent of \$2.50?

$\$1.50 = \frac{P}{100}(\$2.50)$

$\frac{\$1.50}{\$.025} = \frac{(\$.025)P}{\$.025}$

$60 = P$

The percentage increase from \$2.50 to \$4.00 is 60%.

From \$4.00 to \$2.50, the amount of change is again \$1.50, but we now need to know

\$1.50 is what percent of \$4.00.

$\$1.50 = \frac{P}{100}(\$4.00)$

$\frac{\$1.50}{\$.04} = \frac{(\$.04)P}{\$.04}$

$37.5 = P$

The percent decrease was 37.5%.

Example 7

The price of an XPOD doeseverything was originally $500; after really fast sales the price was raised by 50%, Once people realized the difficulty of getting the XPOD to do *anything*, the price was reduced by 50%. What was the price of the XPOD after these two price changes?

Original price was $500

first new price was $500 + .50($500)
= $750

The ultimate price was
$750 - .50($750) = $375

Example 8

The Fixed Network developed a new show, the M.B., about typical teenagers who live in a colony built on the moon. The network originally charged $178.80 for one second of advertising on the M.B., but the show was such a hit that Fixed immediately raised the advertising charge by 40%. What was the new charge for one second of advertising on the M.B.?

$178.80 + .40($178.80) = $250.32

The new charge per second was
$250.32

Example 9

Abercrombie Light had a sale on their line of Holster jeans. The price on all Holster jeans was reduced by 40%. What was the sale price on a pair of jeans that cost $298 before the sale?

$298 - .40($298) = $178.8

The "sale" price was $178.80.

$7x - 3x = (7-3)x$

$6x - x = (6-1)x$

$x - .30x = (1-.3)x$

$= .7x$

Example 10

Eddie Geezer had a sale on support hose. After a 30% reduction, the price on a pair of Argyle support-hose was $6.16. What was the non-sale price of the hose?

Define your variable to be the **original price of the hose.**

The equation comes from the discounted price of the hose.

Solve and check your equation and then state your conclusion using a complete sentence.

Let x be the original price ($).

$x - .30x = \$6.16$

$.70x = \$6.16$

$\frac{.70x}{.7} = \frac{\$6.16}{.7}$

$x = \$8.80$

The original price was $8.80

Check

$.30(8.80) = 2.64$

$8.80 - 2.64 = 6.16$ ✓

Example 6

Texaconjob realized that if they continued the current price for unleaded gasoline they would earn only 500 million dollars in profit over the next week. Faced with such dire profit predictions, they naturally raised the price of a gallon of unleaded gas by 10%. The new price of a gallon of unleaded at Texaconjob was $\$3.19\frac{9}{10}$. What was the price before the oh-so-necessary price hike?

Let x be the original price ($)

$x + .10x = 3.199$

$1.1x = 3.199$

$\frac{1.1x}{1.1} = \frac{3.199}{1.1}$

$x \approx 2.90\frac{9}{10}$

The original price was $\$2.90\frac{9}{10}$

$.10(2.909) = .2909$

$2.909 + .2909 = 3.1999$ ✓

miles per hour = $\frac{\text{miles}}{\text{hr}}$

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82 per cent = $\frac{82}{100}$

Example 1

Write each percent as a fraction (out of 100) and as a decimal.

a. 32%

$32\% = \frac{32}{100}$

$= .32$

b. 7%

$7\% = \frac{7}{100}$

$= .07$

c. 719%

$719\% = \frac{719}{100}$

$= 7.19$

d. 0.2%

$0.2\% = \frac{.2}{100}$

$= .002$

Example 2

Write each decimal as a fraction (out of 100) and as a percent.

a. .76

$.76 = \frac{76}{100}$

$= 76\%$

b. .003

$.003 = \frac{.3}{100}$

$= .3\%$

c. 6

$6 = \frac{600}{100}$

$= 600\%$

d. .04

$.04 = \frac{4}{100}$

$= 4\%$

Example 3

Write each sentence as an equation and then solve (as necessary).

a. $30 is 50% of $60.

$$\$30 = \frac{50}{100}(\$60)$$

b. A is P percent of B

$$A = \frac{P}{100}(B)$$

c. 84 cows is what percent of 210 cows?

$$84 \text{ cows} = \frac{P}{100}(210 \text{ cows})$$

$$84 \text{ cows} = (2.1 \text{ cows})P$$

$$\frac{84 \text{ cows}}{2.1 \text{ cows}} = \frac{(2.1 \text{ cows})P}{2.1 \text{ cows}}$$

$$40 = P$$

So, 84 cows is 40% of 210 cows

d. What is 40% of 968 acres?

$$A = \frac{40}{100}(968 \text{ acres})$$

$$= 387.2 \text{ acres}$$

40% of 968 acres is 387.2 acres.

e. 10,881 is 225% of what number?

$$10,881 = \frac{225}{100}B$$

$$\frac{10,881}{2.25} = \frac{2.25B}{2.25}$$

$$4836 = B$$

The number is 4836