

Formula Manipulation

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PRE-CALCULUS 11 MATH 10 REVIEW FORMULA MANIPULATION

There are many formulas used in the areas of mathematics and science. Take, for example, the scientific formula to calculate the final velocity of an object $v = u + at$ (where u is the initial velocity, a is the acceleration and t is the time). This formula is great if you are looking for the final velocity. But what if you know an objects final velocity but want to know the acceleration? Does this mean we need to memorize formulas to solve for each variable? The answer is NO! It is obviously not practical to have to memorize so many possible formulas to solve for all variable. Instead we can manipulate the formula algebraically to solve for any unknown in the formula.

$$v = u + at$$

Notice that the formula looks much like a Grade 10 equation except instead of numbers we have more variables. Algebra skills are applied in exactly the same way but rather than solving the number parts we will just leave the variables to create a new version of the formula.

Solved for u

$$v = u + at$$

$-at$ $-at$

$$v - at = u$$
$$\boxed{u = v - at}$$

Solved for t

$$v = u + at$$

$-u$ $-u$

$$v - u = at$$
$$\frac{v - u}{a} = t$$
$$\boxed{t = \frac{v - u}{a}}$$

Solved for a

$$v = u + at$$

$-u$ $-u$

$$v - u = at$$
$$\frac{v - u}{t} = a$$
$$\boxed{a = \frac{v - u}{t}}$$

A. Practice Questions

1) Solve each of the following for the variable indicated.

a) $E = mc^2$, for m

$$\frac{E}{c^2} = \frac{mc^{\cancel{2}}}{\cancel{c^2}}$$

$$\frac{E}{c^2} = m$$

$$m = \frac{E}{c^2}$$

b) $P = 2l + 2w$, for l

$$P = 2l + \cancel{2w}$$

$$\frac{P - \cancel{2w}}{2} = \frac{\cancel{2}l}{\cancel{2}}$$

$$l = \frac{P - 2w}{2}$$

c) $a^2 + b^2 = c^2$, for b

$$\cancel{a^2} + b^2 = c^2 - \cancel{a^2}$$

$$b^2 = c^2 - a^2$$

$$b = \sqrt{c^2 - a^2}$$

d) $n = 17 - \frac{1}{2}(a - 4)$, for a

$$2 \left[n = 17 - \frac{1}{2}a + 2 \right]$$

$$2n = 34 - a + 4$$

$$2n = -a + 38$$

$$2n - 38 = -a$$

$$a = -2n + 38$$

2) The length (l), in centimetres, of a rubber band suspending a mass (m), in grams, is given the formula $l = 14.3 + 0.27m$.

a) Solve the formula for m .

$$l = \cancel{14.3} + 0.27m$$

$$\frac{l - \cancel{14.3}}{0.27} = \frac{\cancel{0.27}m}{\cancel{0.27}}$$

$$m = \frac{l - 14.3}{0.27}$$

b) Find the mass, to the nearest gram, of a rubber band that stretches 98 cm. ^{length}

$$m = \frac{l - 14.3}{0.27}$$

$$m = \frac{(98) - 14.3}{0.27}$$

$$m = 310g$$

Assignment: Formula Manipulation Assignment #1 - 20

PRE-CALCULUS 11
MATHEMATICS 10 REVIEW
FORMULA MANIPULATION ASSIGNMENT

A. Solve each of the following for x .

1) $x + n = p$

2) $8x = m$

3) $px = n$

4) $ax - b = c$

5) $t - mx = p$

6) $wx + 5 = v$

B. Solve each of the following for the variable indicated.

7) $I = prt$, for t

8) $P = 2l + w$, for l

9) $A = \frac{bh}{2}$, for h

10) $C = 2\pi r$, for r

11) $M = 2Vd - 5p$, for p

12) $K = \frac{mv^2}{2}$, for m

13) $I = \frac{DQ}{dt}$, for t

14) $M = \frac{ab^2 + c}{d}$, for c

15) $V = \pi r^2 h$, for r

16) $V = \frac{1}{3}\pi r^2 h$, for h

17) $C = 3 + 0.5(n - 3)$, for n

18) $M = N(a + b)$, for b

19) The formula for Surface Area of a Sphere is $SA = 4\pi r^2$. Create a new formula which solves for r , and then use the formula to determine the radius of a sphere with a surface area of 2827.43 cm^2 .

20) The formula to find the Surface Area of a Cylinder is $A = 2\pi rh + 2\pi r^2$. Find the height of a cylinder with a radius of 8 cm and a surface area of 1156.11 cm^2 .

Answers

1) $x = p - n$

2) $x = \frac{m}{8}$

3) $x = \frac{n}{pf}$

4) $x = \frac{c+b}{a}$

5) $x = \frac{-p+t}{m}$

6) $x = \frac{v-5}{w}$

7) $t = \frac{I}{pr}$

8) $l = \frac{p-w}{2}$

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

10) $r = \frac{C}{2\pi}$

11) $p = \frac{-M+2Vd}{5}$

12) $m = \frac{2K}{v^2}$

13) $t = \frac{DQ}{Id}$

14) $c = Md - ab^2$

15) $r = \sqrt{\frac{V}{\pi h}}$

16) $h = \frac{3V}{\pi r^2}$

17) $n = \frac{C-1.5}{0.5}$

18) $b = \frac{M-Na}{N}$

19) $r = \sqrt{\frac{SA}{4\pi}}$, 15 cm

20) 15 cm