



Changing the Subject of a Formula

Aim: To get the desired letter on its own, on the left-hand side of the = sign.

Golden Rule:

Do the same thing to both sides of the = sign

Examples

The following examples show various types of formulas, each with several different letters, along with some different approaches to changing their subject.

1) Make r the subject of the formula $C = 2\pi r$.

$$\frac{C}{2\pi} = r \quad \text{Divide both sides by } 2\pi$$
$$r = \frac{C}{2\pi} \quad \text{Swap sides}$$

2) Make t the subject of the formula $s = \frac{d}{t}$.

$$st = d \quad \text{Multiply both sides by } t$$
$$t = \frac{d}{s} \quad \text{Divide both sides by } s$$

3) Make r the subject of the formula $A = \pi r^2$.

$$\frac{A}{\pi} = r^2 \quad \text{Divide both sides by } \pi$$
$$r^2 = \frac{A}{\pi} \quad \text{Swap sides}$$
$$r = \sqrt{\frac{A}{\pi}} \quad \text{Square root both sides}$$

4) Make b the subject of the formula $A = \frac{h}{2}(a + b)$.

$$2A = h(a + b) \quad \text{Multiply both sides by } 2$$
$$\frac{2A}{h} = a + b \quad \text{Divide both sides by } h$$
$$\frac{2A}{h} - a = b \quad \text{Subtract } a \text{ from both sides}$$
$$b = \frac{2A}{h} - a \quad \text{Swap sides}$$



Exercises

Make the letter in the brackets the subject of each formula.

1. $F = ma$ [a]

11. $T = 2\pi\sqrt{\frac{l}{g}}$ [l]

2. $V = \frac{m}{d}$ [m]

12. $\frac{a}{\sin(A)} = \frac{b}{\sin(B)}$ [a]

3. $V = \frac{m}{d}$ [d]

13. $s = ut + \frac{1}{2}at^2$ [u]

4. $v = u + at$ [t]

14. $E = k\frac{q}{r^2}$ [q]

5. $v = \sqrt{2gh}$ [h]

15. $E = k\frac{q}{r^2}$ [r]

6. $\rho = \frac{m}{v}$ [v]

16. $m_g v_g = m_p v_p$ [m_g]

7. $PV = nRT$ [R]

17. $F = \frac{mv^2}{r}$ [m]

8. $T = \frac{mv^2}{L}$ [m]

18. $F = \frac{mv^2}{r}$ [r]

9. $T = \frac{mv^2}{L}$ [v]

19. $F = \frac{mv^2}{r}$ [v]

10. $v = \sqrt{rg}$ [r]

20. $\frac{1}{A} = \frac{1}{B} + \frac{1}{C}$ [B]



ANSWERS

1. $a = \frac{F}{m}$

2. $m = dV$

3. $d = \frac{m}{v}$

4. $t = \frac{v-u}{a}$

5. $h = \frac{v^2}{2g}$

6. $v = \frac{m}{\rho}$

7. $R = \frac{PV}{nT}$

8. $m = \frac{LT}{v^2}$

9. $v = \sqrt{\frac{LT}{v^2}}$

10. $r = \frac{v^2}{g}$

11. $l = g \left(\frac{T}{2\pi} \right)^2$

12. $a = b \frac{\sin(A)}{\sin(B)}$

13. $u = \frac{s}{t} - \frac{1}{2}at$

14. $q = \frac{Er^2}{k}$

15. $r = \sqrt{\frac{kq}{E}}$

16. $m_g = \frac{m_g v_p}{v_g}$

17. $m = \frac{Fr}{v^2}$

18. $r = \frac{mv^2}{F}$

19. $v = \sqrt{\frac{rF}{m}}$

20. $B = \frac{AC}{C-A}$