

# Physics, Foundation Programme – Problem Solving Exercises 3

## Solving Equations I

1. Solve each equation and check your solution:

a)  $3x - 1 = x + 1$  a:  $x=1$

b)  $\frac{7y - 1}{3} + \frac{5 + 3y}{2} = 5y - 6$  a:  $y=7$

c)  $6(5s - 11) - 12(2s + 5) = 0$  a:  $s=21$

d)  $(z - 3)(z + 2) - (z + 2)(z - 4) = 7$  a:  $z=5$

e)  $\frac{6 + 25x}{15} - (x - 1) = \frac{2x}{3} + \frac{7}{5}$  a: identity, infinite many solutions

f)  $2s - \frac{5s - 3}{4} = \frac{3s - 5}{4}$  a: no solution

g)  $\frac{3 + x}{2} - \left( \frac{7 - x}{3} - \frac{x + 3}{4} \right) + \frac{7 - x}{6} - \frac{9 + 7x}{8} + x = 0$  a:  $x=1/25$

h)  $*(5x - 4)^2 - (5 - 3x)^2 = (3 - 4x)^2$  a:  $\frac{9}{7}$

i)  $0.04x - 0.02 = 0.07 + 0.10x$  a:  $x = -\frac{3}{2}$

2. Solve each rational equation and check the solution:

a)  $\frac{1}{x - 2} - \frac{2}{3(x - 2)} = \frac{1}{3}$  a:  $x = 3, x \neq 2$

b)  $\frac{6}{x - 5} + 1 = \frac{2x - 4}{x - 5}$  a: NO solution, after multiplication of the eq. by  $(x-5)$ :  
a=5, but with the restriction  $a \neq 5$

c)  $\frac{2}{y - 3} - \frac{1}{y + 2} = \frac{1}{y + 6}$  a:  $y = -\frac{24}{7} = -3\frac{3}{7}$

$$d) \frac{3}{v+1} = \frac{2}{v+3} + \frac{1}{v-2} \quad a: v = 17$$

3. Solve systems of linear equations and check your solution:

$$a) 6x + 5y = 1 \text{ and } x - 3y = 4 \quad a: x=1; y=-1$$

$$b) \frac{3}{4}x + \frac{1}{3}y = 1 \text{ and } \frac{1}{2}x + \frac{2}{3}y = 0 \quad a: x = 2, y = -\frac{3}{2}$$

$$c) 2v + 3t = 8 \text{ and } 4 - v = \frac{3}{2}t \quad a: \text{all pairs } t = c, v = 4 - \frac{3}{2}c, c \in \mathbb{R}$$

$$d) 4x - 2y = 2 \text{ and } -x + \frac{1}{2}y = 8 \quad a: \text{contradiction, no solution}$$

$$e) \begin{aligned} x + y - z &= 17 \\ x + z - y &= 13 \\ y + z - x &= 7 \end{aligned} \quad a: x=15, y=12, z=10$$

4. How many liters of a 40% sulfuric acid solution should be mixed with 4 liters of a 24% sulfuric acid solution to produce a 30% solution?

$$A: V=2.4 \text{ L}$$

5. A radiator contains 6 liters of a 25% antifreeze solution. How much should be drained and replaced with pure antifreeze to produce a 33% antifreeze solution?

$$A: V=0.64 \text{ L}$$

6. A car traveling at 80 kilometers per hour is passed by a second car going in the same direction at a constant speed. After 30 seconds, the two cars are 500 meters apart. Find the speed of the second car.

$$A: v=140 \text{ km/h}$$

7. A painter can paint a kitchen in 10 hours. An apprentice can paint the same kitchen in 15 hours. If they worked together, how long would it take them to paint the kitchen?

$$A: t= 6 \text{ hours}$$

8. A mason can lay the bricks in a sidewalk in 12 hours. The mason's apprentice requires 16 hours to do the same job. After working together for 4 hours, the mason leaves for another job, and the apprentice continues working. How long will it take the apprentice to complete the job?

A:  $t = 6\frac{2}{3}$  hours = 6 hours 40 min.