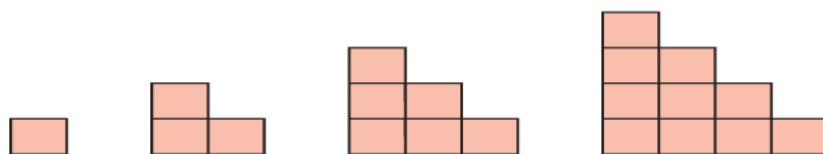


Text & Tests 6

Revision Questions on Chapter 1 Algebra 1

Revision Exercise (Advanced)

1. By converting the following designs into a number pattern, write down a rule for the pattern. Use the rule to find out how many bricks are needed to build the 49th design.



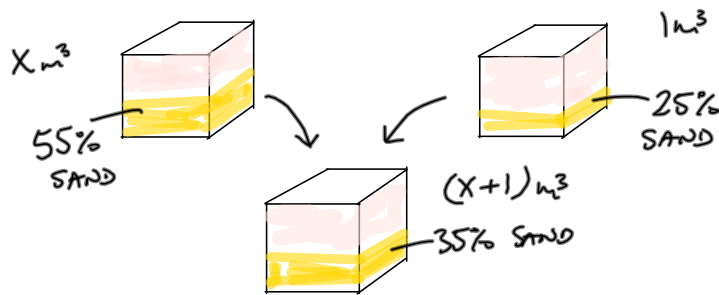
PATTERN	1 = 1	3	6	10
1st Difference		2	3	4
2nd Difference			1	1

Rule: $ax^2 + b$
 $\frac{1}{2}x^2 + 1$

$1 = 2a$
 $\Rightarrow a = \frac{1}{2}$

2. How much soil containing 55% sand needs to be added to 1 m^3 of soil containing 25% sand to make soil containing 35% sand?

Hint: let $x \text{ m}^3$ be the amount of soil needed.

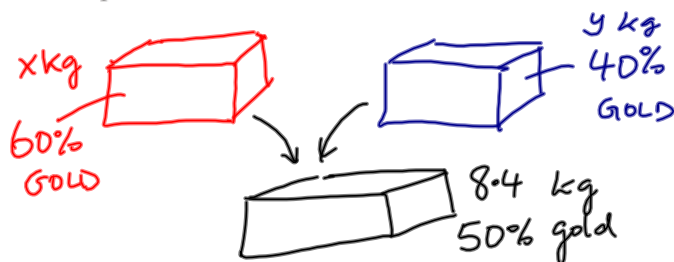


$$\begin{aligned}
 55(x) + 25(1) &= 35(x+1) \\
 55x + 25 &= 35x + 35 \\
 20x &= 10 \\
 x &= \frac{1}{2} \text{ m}^3
 \end{aligned}$$

3. A metallurgist needs to make 8.4 kg of an alloy containing 50% gold. He is going to melt two metal alloys, one containing 60% gold with a second metal alloy that contains 40% gold.

(i) Let $x \text{ kg}$ and $y \text{ kg}$ be the amounts needed of each metal alloy. Write two equations linking the unknowns x and y .

(ii) Solve the equations to find the amount of each metal needed.



$$\begin{aligned}
 x + y &= 8.4 \\
 60x + 40y &= 50(8.4) = 420 \\
 \Rightarrow 3x + 2y &= 21
 \end{aligned}
 \quad \left| \quad \begin{aligned}
 3x + 2y &= 21 \\
 -2x - 2y &= -16 \\
 \hline
 x &= 5 \text{ kg} \\
 y &= 8.4 - 5 = 3.4 \text{ kg}
 \end{aligned}$$

4. If, for all values of x , $(3p - 2t)x + r - 4t^2 = 0$, show that $r = 9p^2$.

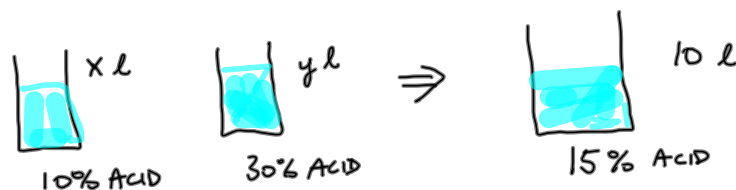
$$\begin{aligned} \Rightarrow 3p - 2t &= 0 & \text{and} & & r - 4t^2 &= 0 \\ & & & & r &= 4t^2 \\ 3p &= 2t \\ \frac{3p}{2} &= t \\ \Rightarrow r &= 4 \left(\frac{3p}{2} \right)^2 = 9p^2 & \checkmark \end{aligned}$$

5. Simplify the equation $\frac{x + y^2}{x^2} + \frac{x - 1}{x} = -1$ and hence find the ratio of x^2 to y^2 .

$$\begin{aligned} \text{multiply by } x^2 & \Rightarrow \cancel{x} - y^2 + x^2 - \cancel{x} = -x^2 \\ & -y^2 = -2x^2 \\ & y^2 = 2x^2 \end{aligned}$$

$$\begin{aligned} \underline{\text{RATIO}} \quad x^2 &: y^2 \\ 2 &: 1 \end{aligned}$$

6. In a chemistry class, a group of students need a 15% acid solution to complete a test. The lab only has 10% acid solution and 30% acid solution. The students decide to mix the two solutions to get the 15% solution they require. If the students need 10 litres of the new solution, find
- the number of litres of the 10% solution they require
 - the number of litres of the 30% solution they require.



$$10x + 30y = 15 \quad (10)$$

$$x + 3y = 15$$

$$x + y = 10$$

$$\begin{array}{r} x + 3y = 15 \\ -x - y = -10 \\ \hline 2y = 5 \\ y = 2.5 \text{ l} \\ x = 10 - 2 \cdot 5 = 7.5 \text{ l} \end{array}$$

7. Brian and Luke race over 50 metres. Brian runs so that it takes a seconds to run 1 metre. Luke runs so that it takes him b seconds to run 1 metre. Luke wins the race by 1 second. The next day, they race again over 50 metres (and again at the same speeds) but Luke gives Brian a 3-metre start so that Brian only runs 47 metres. Luke wins this race by 0.1 seconds. Find

- the values of a and b
- Luke's speed.

$$\text{Time} = \frac{\text{DISTANCE}}{\text{SPEED}}$$

50m Race



RACE 1

$$\text{Brian's Time} = \frac{50}{a}$$

$$\text{Luke's Time} = \frac{50}{b}$$

$$\frac{50}{a} - \frac{50}{b} = 1 \quad \text{multiply by } ab$$

$$\Rightarrow 50b - 50a = ab$$

RACE 2

$$\text{Brian's Time} = \frac{47}{a}$$

$$\text{Luke's Time} = \frac{50}{b}$$

$$\frac{47}{a} - \frac{50}{b} = 0.1 \quad \text{multiply by } ab$$

$$\Rightarrow 47b - 50a = 0.1 ab$$

$$50b - 50a = ab$$

$$-47b + 50a = -0.1 ab$$

$$3b = 0.9 ab$$

$$a = \frac{3}{0.9} = \frac{10}{3} = 3\frac{1}{3}$$

$$50b - 50\left(\frac{10}{3}\right) = b\left(\frac{10}{3}\right)$$

$$150b - 100b = 500$$

$$b = \frac{500}{140} = 3\frac{4}{7}$$

$$\text{LUKE'S SPEED} = 3\frac{4}{7} \text{ m/s}$$