2010 Primary Set 3 solutions

P3.1 A Brachiosaurus is 37 metres long.

Its neck is twice as long as its tail and its body is 2 metres longer than half of its tail.

How long are each of the neck, body and tail of the Brachiosaurus?

Solution 1

We can work in terms of the length of the tail. Together the neck and the tail are 3 times the length of the tail and the body conatins half a tail length. So from this we can say that $3\frac{1}{2}$ tail lengths must be (37 − 2) metres.

So $3\frac{1}{2}$ tail lengths must be 35 metres.

So $\frac{1}{2}$ tail lengths must be $\frac{1}{7} \times 35$ metres which is 5 metres.

So the tail is 10 metres, the neck is 20 metres and the body is 7 metres.

Solution 2

Let t = the length of the tail. Then

$$t + 2t + \tfrac{1}{2}t + 2 = 37$$

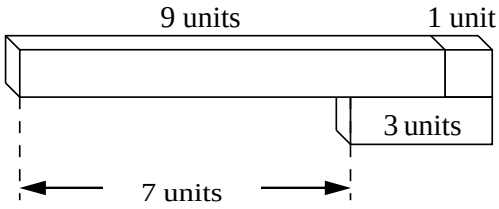
$$3\tfrac{1}{2}t = 35$$

$$7t = 70$$

$$t = 10$$

So the tail = 10m, neck = 20m, body = 7m

P3.2 You are given three rods of lengths 1, 3 and 9 units. Using these rods, you could measure 7 units as shown.



Show how you could measure each whole number length up to 13 units.

By adding a fourth rod, it is possible to measure all whole number lengths up to 40 units. What is the length of this extra rod?

Explain your answer.

Solution

Length	1	2	3	4	5	6	7	8
Rods	1	3 − 1	3	3 + 1	9 − 3 − 1	9 − 3	9 − 3 + 1	9 − 1

	9	10	11	12	13
	9	9 + 1	9 + 3 − 1	9 + 3	9 + 3 + 1

Add a 27 unit rod so that $14 = 27 - 13$, $15 = 27 - 12$, . . . , $39 = 27 + 12$, $40 = 27 + 13$

P3.3

You have three boxes, each containing two *identically* wrapped Easter eggs.

One box contains two milk chocolate eggs (M), one contains two plain chocolate eggs (P) and the third contains one *milk chocolate* egg and one *plain chocolate* egg. The boxes are labelled MM, PP or MP according to their contents.

However, someone has switched all the labels so that every box is now incorrectly labelled.

You are allowed to take out one egg at a time *from* any box, check what type it is and put it back. By doing this you can correctly label all three boxes.

What is the smallest number of eggs you would need to check in order to label the boxes correctly?

Explain your answer.

Solution

Labelled boxes: MM, MP and PP all incorrect.

Labels	MM	MP	PP
Actual contents	MP or PP	MM or PP	MP or MM

If you pick an egg from the MM labelled box and it is P then you don't know if it contains MP or PP.

If you pick an egg from the PP labelled box and it is M then you don't know if it contains MP or MM.

However, if you pick an egg from the MP labelled box then

If it is P you know that the box contains PP – solution below

Labels	MP	MM	PP
Selection	P		
Actual contents	PP	MP	MM

And if you pick out a M then you know that it has to be MM giving the solution below

Labels	MP	PP	MM
Selection	M		
Actual contents	MM	MP	PP

So the smallest number of samples is to take one from the box incorrectly labelled MP.