

1. There are only green pens and blue pens in a box.

There are three more blue pens than green pens in the box.

There are more than 12 pens in the box.

Simon is going to take at random two pens from the box.

The probability that Simon will take two pens of the same colour is  $\frac{27}{55}$

Work out the number of green pens in the box.

Let  $x$  be the number of green pens

$$\text{green} = x$$

$$\text{blue} = x + 3$$

$$\text{total} = 2x + 3$$

$$P(\text{green}) = \frac{x}{2x+3}$$

$$P(\text{blue}) = \frac{x+3}{2x+3}$$

$$P(2 \text{ green}) = \frac{x}{2x+3} \times \frac{x-1}{2x+2} = \frac{x(x-1)}{(2x+3)(2x+2)}$$

$$P(2 \text{ blue}) = \frac{x+3}{2x+3} \times \frac{x+2}{2x+2} = \frac{(x+3)(x+2)}{(2x+3)(2x+2)}$$

$$P(2 \text{ green}) + P(2 \text{ blue}) = \frac{27}{55}$$

$$\frac{x(x-1)}{(2x+3)(2x+2)} + \frac{(x+3)(x+2)}{(2x+3)(2x+2)} = \frac{27}{55}$$

$$\frac{x(x-1) + (x+3)(x+2)}{(2x+3)(2x+2)} = \frac{27}{55}$$

$$\frac{2x^2 + 4x + 6}{4x^2 + 10x + 6} = \frac{27}{55}$$

$$\frac{x^2 + 2x + 3}{2x^2 + 5x + 3} = \frac{27}{55}$$

$$\times 55(2x^2 + 5x + 3)$$

$$55(x^2 + 2x + 3) = 27(2x^2 + 5x + 3)$$

$$55x^2 + 110x + 165 = 54x^2 + 135x + 81$$

$$x^2 - 25x + 84 = 0$$

$$(x-4)(x-21) = 0$$

$$x \geq 12$$

$$\therefore x = 21$$

(Total for Question 1 is 6 marks)

21

2. There are only  $r$  red counters and  $g$  green counters in a bag.

A counter is taken at random from the bag.

The probability that the counter is green is  $\frac{3}{7}$

The counter is put back in the bag.

2 more red counters and 3 more green counters are put in the bag.

A counter is taken at random from the bag.

The probability that the counter is green is  $\frac{6}{13}$

Find the number of red counters and the number of green counters that were in the bag originally.

	$P(\text{Green})$	$P(\text{Red})$
original	$\frac{3x}{7x}$	$\frac{4x}{7x}$
After more counters added.	$\frac{3x+3}{7x+5}$	$\frac{4x+2}{7x+5}$ (1)

$$\frac{3x+3}{7x+5} = \frac{6}{13} \quad (1)$$

$$13(3x+3) = 6(7x+5)$$

$$39x + 39 = 42x + 30 \quad (1)$$

$$39 = 3x + 30$$

$$9 = 3x$$

$$\therefore x = 3 \quad (1)$$

$\therefore$  number of red =

$$4x = 4(3) = \boxed{12}$$

number of green =

$$= 3x = 3(3) = \boxed{9} \quad (1)$$

red counters..... 12

green counters..... 9

(Total for Question is 5 marks)

3. There are  $p$  counters in a bag.  
12 of the counters are yellow.

Shafiq takes at random 30 counters from the bag.  
5 of these 30 counters are yellow.

Work out an estimate for the value of  $p$ .

$$\frac{12}{p} \text{ are yellow}$$

$$\text{On one random trial}$$

$$\frac{5}{30} \text{ were yellow}$$

$$\frac{5}{30} \xrightarrow{\times \frac{12}{5}} \frac{12}{72}$$

Since  $\frac{12}{p}$  are yellow  
we can estimate  
 $p = 72$

$$\frac{30}{1} \times \frac{12}{5} = \frac{30 \times 12}{5} = \frac{\cancel{3} \times 6 \times 12}{\cancel{5}} = 6 \times 12 = 72$$

$$72 \text{ (1)}$$

4. There are only red sweets and yellow sweets in a bag.

There are  $n$  red sweets in the bag.

There are 8 yellow sweets in the bag.

Sajid is going to take at random a sweet from the bag and eat it.

He says that the probability that the sweet will be red is  $\frac{7}{10}$

- (a) Show why the probability cannot be  $\frac{7}{10}$   $p(\text{red}) = \frac{n}{n+8} = \frac{7}{10}$

$$10n = 7n + 56$$

$$3n = 56$$

$$n = \frac{56}{3}$$

$n$  must be a whole number.  $\frac{56}{3}$  is not

whole  $\therefore n \neq \frac{56}{3}$  (3)

After Sajid has taken the first sweet from the bag and eaten it, he is going to take at random a second sweet from the bag.

Given that the probability that both the sweets he takes will be red is  $\frac{3}{5}$

- (b) work out the number of red sweets in the bag.

You must show all your working.

$$n = \frac{-(-25) \pm \sqrt{(-25)^2 - 4(-84)}}{2}$$

$$= -3, 28$$

$$\frac{n}{n+8} \times \frac{n-1}{n+7} = \frac{3}{5}$$

$$\frac{n^2 - n}{n^2 + 15n + 56} = \frac{3}{5} \rightarrow 5n^2 - 5n = 3n^2 + 45n + 168$$

$$2n^2 - 50n - 168 = 0$$

$$n^2 - 25n - 84 = 0$$

$$(n+3)(n-28) = 0 \text{ so } n = -3 \text{ or } 28$$

$$n > 0 \therefore n \neq -3 \text{ and } n = 28$$

.....  
(5)

**(Total for Question is 8 marks)**

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