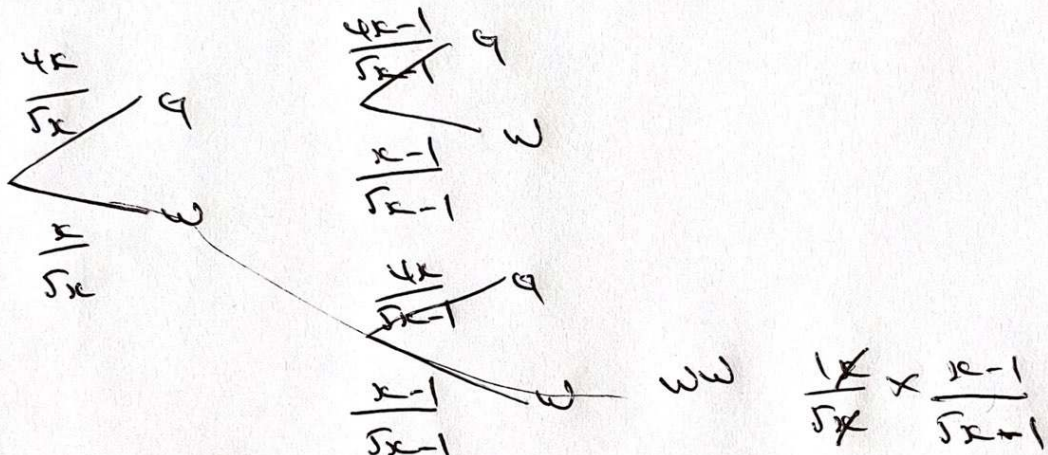# QT Probability Equations

1. There are some green counters and white counters in a bag.
The ratio of green counters to white counters is 4:1.
Two counters are removed at random.

The probability that both the counters are white is $\frac{1}{30}$

How many counters were in the bag before any counters were removed?

Total
$5x$

Green $4x$
white $1x$

$$\frac{1}{5}\frac{(x-1)}{(5x-1)} = \frac{1}{30}$$

$$30(x-1) = 5(5x-1)$$
$$30x - 30 = 25x - 5$$

$$ww \quad \frac{1x}{5x} \times \frac{x-1}{5x-1}$$

$$5x = 25$$
$$x = 5.$$

white 5
Green 20
Total $\underline{\underline{25}}$
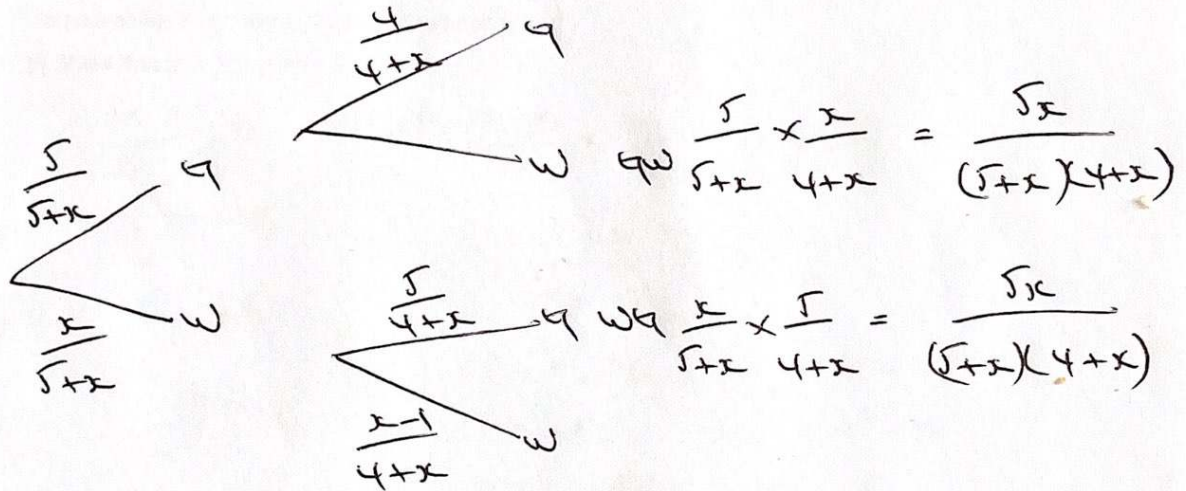
2. There are 5 green counters and x white counters in a bag.
Two counters are removed at random.

The probability that one counter is green, and the other counter is white is $\frac{6}{11}$

How many white counters were in the bag before any were removed?

Total $5+x$
green 5.
white x

$$\frac{5}{5+x} \times \frac{x}{4+x} = \frac{5x}{(5+x)(4+x)}$$

$$\frac{x}{5+x} \times \frac{5}{4+x} = \frac{5x}{(5+x)(4+x)}$$

$$\frac{10x}{(5+x)(4+x)} = \frac{6}{11}$$

$$110x = 6(5+x)(4+x)$$

$$110x = 6(20 + 9x + x^2)$$

$$0 = 120 - 56x + 6x^2$$

$$6x^2 - 56x + 120 = 0$$

$$3x^2 - 28x + 60 = 0$$

$$\begin{array}{c} 180 \\ \diagup \diagdown \\ -18 \quad -10 \end{array}$$

$$3x^2 - 18x - 10x + 60 = 0$$

$$3x(x-6) - 10(x-6) = 0$$

$$(3x - 10)(x - 6) = 0$$

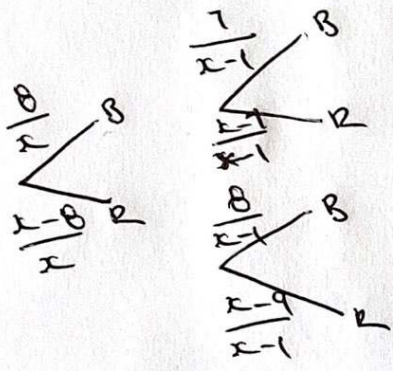$$\therefore x = \frac{10}{3} = 3.\dot{3} \text{ (not possible)}$$

$$x = 6 \qquad \text{6 white counters}$$

3. There are x pens in a box.

8 of the pens are blue, and the rest are red.

Ahmed takes a random pen from the box and does not replace it.

He then takes another random pen from the box.

The probability that Ahmed takes two red pens is $\frac{1}{5}$

(a) Show that $x^2 - 21x + 90 = 0$

$\text{Total} = x$

$\text{Blue} = 8$

$\text{Red} = x - 8$

$RR \quad \dfrac{x-8}{x} \times \dfrac{x-9}{x-1} = \dfrac{1}{5}$

$\dfrac{(x-8)(x-9)}{x(x-1)} = \dfrac{1}{5}$

$5(x^2 - 17x + 72) = x^2 - x$

$5x^2 - 85x + 360 = x^2 - x$

$4x^2 - 84x + 360 = 0 \qquad \div 4$

$x^2 - 21x + 90 = 0$

(b) Find the value of x

$x^2 - 21x + 90 = 0$

$(x - 6)(x - 15) = 0$

$x = 6 \text{ or } 15.$

x must be more than 8 as there are both blue & red pens in the box.

∴ x must be 15.