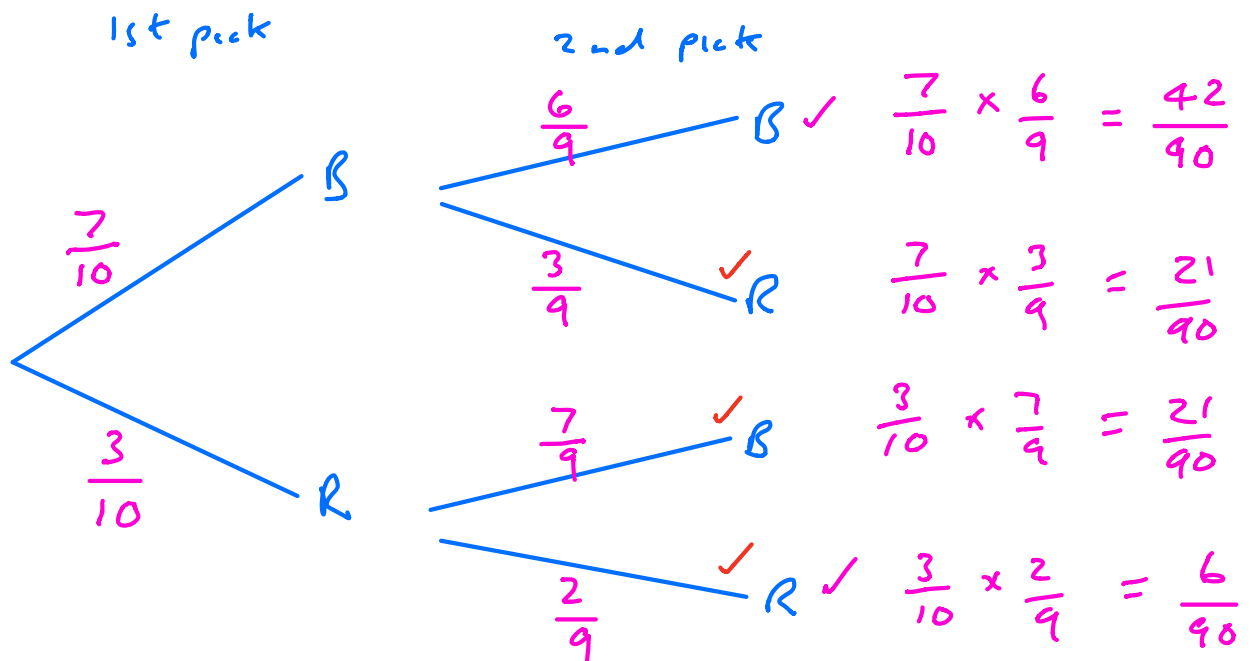1.   A bag contains 7 blue balls and 3 red balls. A ball is selected at random, its colour noted and it is replaced. A second ball is selected at random and its colour noted. Represent the various possible outcomes on a probability tree and calculate:

a)   The probability both balls selected are the same colour.

b)   The probability at least one of the balls is red.

what if the first ball is NOT replaced?

1st pick   2nd pick

$\frac{7}{10}$ B

$\frac{6}{9}$ ──── B ✓ $\frac{7}{10} \times \frac{6}{9} = \frac{42}{90}$

$\frac{3}{9}$ ──── R ✓ $\frac{7}{10} \times \frac{3}{9} = \frac{21}{90}$

$\frac{3}{10}$ R

$\frac{7}{9}$ ──── B ✓ $\frac{3}{10} \times \frac{7}{9} = \frac{21}{90}$

$\frac{2}{9}$ ──── R ✓ $\frac{3}{10} \times \frac{2}{9} = \frac{6}{90}$

a) $Prob(\text{Same Colour}) = \frac{42}{90} + \frac{6}{90} = \frac{48}{90}$

$Prob(\text{At least 1 Red}) = \frac{21}{90} + \frac{21}{90} + \frac{6}{90} = \frac{48}{90}$

or $1 - Prob(\text{Both Blue})$
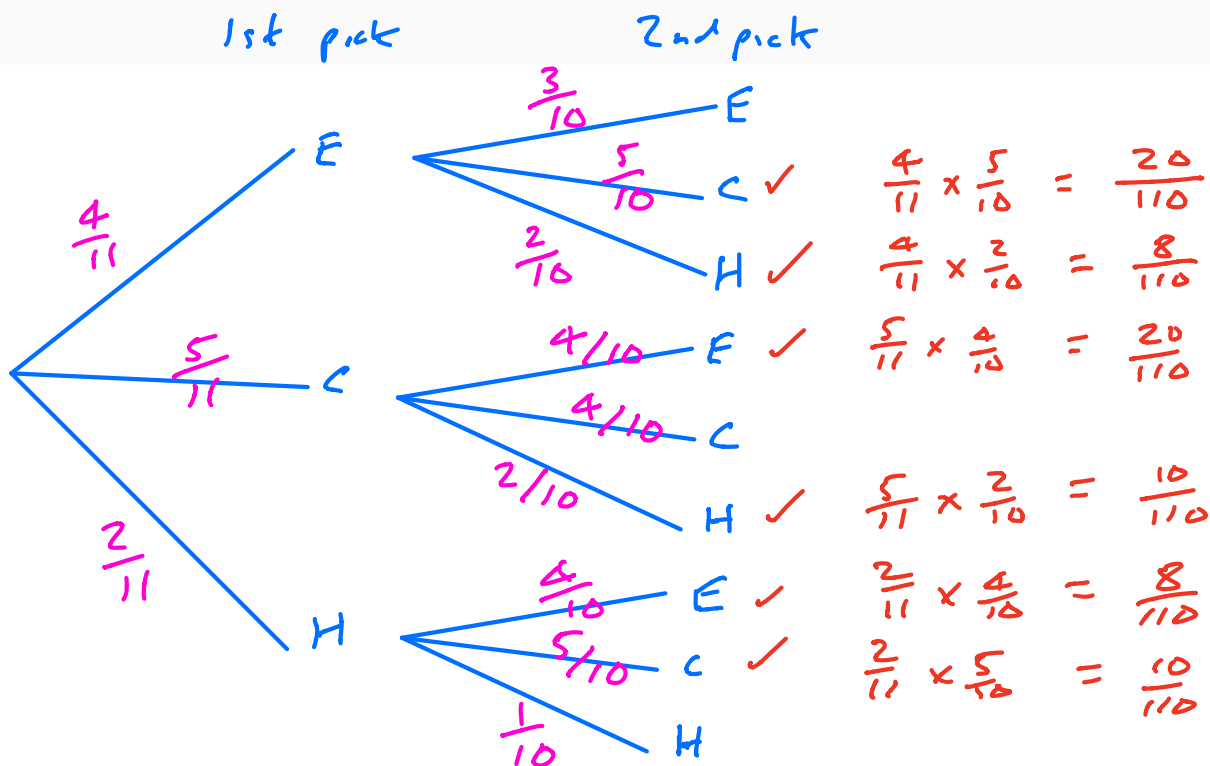
$= 1 - \frac{42}{90} = \frac{48}{90}$

19. There are three different types of sandwiches on a shelf.

There are

  4 egg sandwiches,
  5 cheese sandwiches
and 2 ham sandwiches.

Erin takes at random 2 of these sandwiches.

Work out the probability that she takes 2 different types of sandwiches.

1st pick   2nd pick

$\frac{3}{10}$ ⟶ E

E

$\frac{5}{10}$ ⟶ C ✓ $\frac{4}{11} \times \frac{5}{10} = \frac{20}{110}$

$\frac{4}{11}$

$\frac{2}{10}$ ⟶ H ✓ $\frac{4}{11} \times \frac{2}{10} = \frac{8}{110}$

$\frac{4}{10}$ ⟶ E ✓ $\frac{5}{11} \times \frac{4}{10} = \frac{20}{110}$

$\frac{5}{11}$ ⟶ C

$\frac{4}{10}$ ⟶ C

$\frac{2}{10}$ ⟶ H ✓ $\frac{5}{11} \times \frac{2}{10} = \frac{10}{110}$

$\frac{2}{11}$

$\frac{4}{10}$ ⟶ E ✓ $\frac{2}{11} \times \frac{4}{10} = \frac{8}{110}$

H

$\frac{5}{10}$ ⟶ C ✓ $\frac{2}{11} \times \frac{5}{10} = \frac{10}{110}$

$\frac{1}{10}$ ⟶ H

$$P(2 \text{ different}) = \frac{20 + 8 + 20 + 10 + 8 + 10}{110}$$

$$= \frac{76}{110}$$

13. There are only

        4 mint biscuits
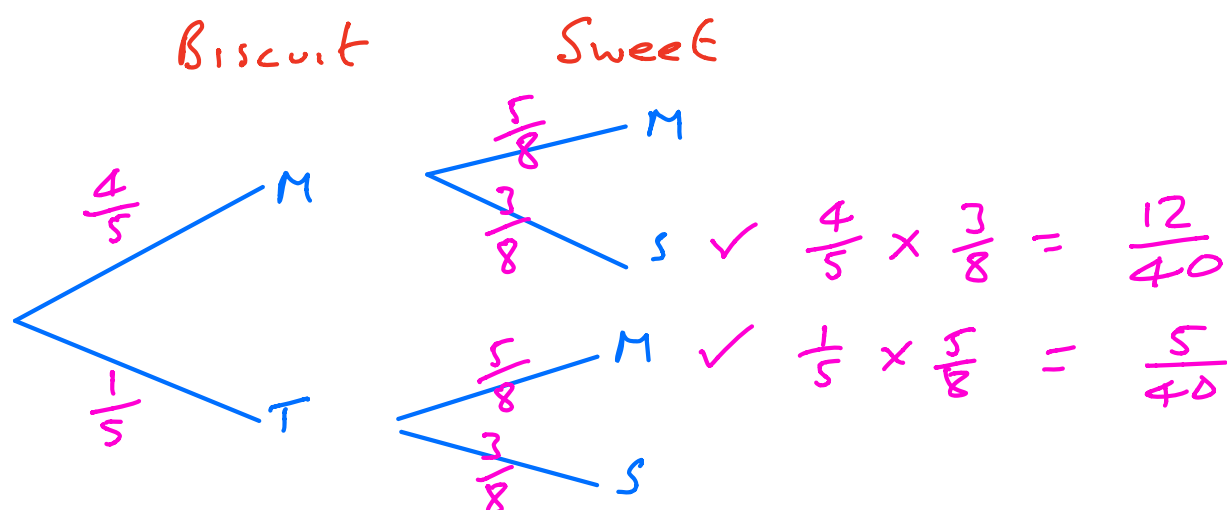   and 1 toffee biscuit in a tin.

There are only

        5 mint sweets
    and 3 strawberry sweets in a packet.

Michael's mum lets him take one biscuit from the tin and one sweet from the packet.

Michael takes a biscuit at random from the tin.
He also takes a sweet at random from the packet.

Work out the probability that either the biscuit is mint or the sweet is mint, but not both.

Biscuit   Sweet

$$\frac{4}{5} \quad M \quad \frac{5}{8} \; M$$
$$\frac{3}{8} \; S \; \checkmark \quad \frac{4}{5} \times \frac{3}{8} = \frac{12}{40}$$
$$\frac{1}{5} \quad T \quad \frac{5}{8} \; M \; \checkmark \quad \frac{1}{5} \times \frac{5}{8} = \frac{5}{40}$$
$$\frac{3}{8} \; S$$

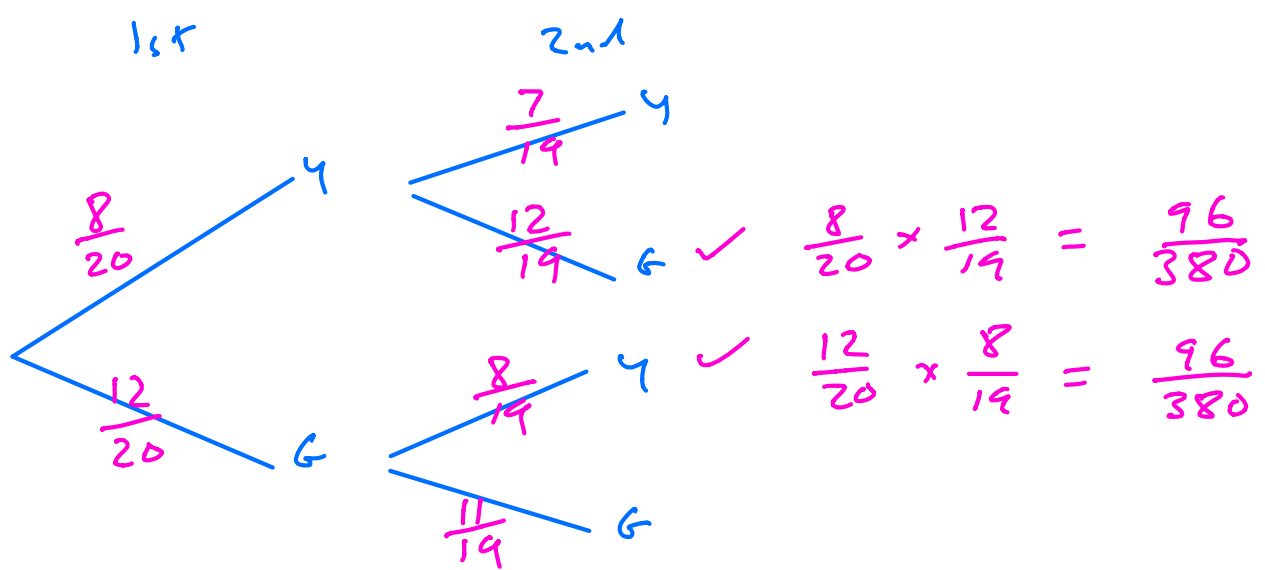$$\text{Prob}(\text{One of them mint}) = \frac{12}{40} + \frac{5}{40} = \frac{17}{40}$$

---

14. There are 20 counters in a bag.

8 of the counters are yellow.
12 of the counters are green.

Asif takes at random two of the counters.

Work out the probability that the two counters are different colours.

$\frac{8}{20}$ — Y

$\frac{7}{19}$ — Y

$\frac{12}{19}$ — G ✓ $\frac{8}{20} \times \frac{12}{19} = \frac{96}{380}$

$\frac{12}{20}$ — G

$\frac{8}{19}$ — Y ✓ $\frac{12}{20} \times \frac{8}{19} = \frac{96}{380}$

$\frac{11}{19}$ — G

$$\text{Prob (Different Colours)} = \frac{96}{380} + \frac{96}{380}$$

$$= \frac{192}{380}$$
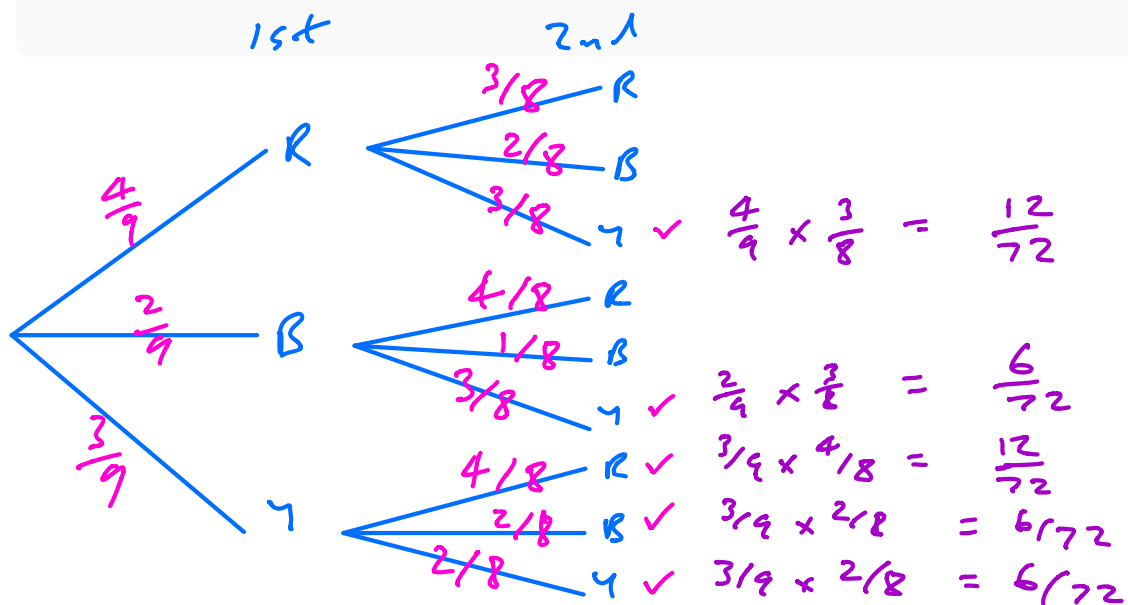
---

12. There are 9 counters in a box.

> 4 of the counters are red.
> 2 of the counters are blue.
> 3 of the counters are yellow.

Pavinder takes at random two counters from the box.

Work out the probability that he takes at least one yellow counter.

1st   2nd

$\frac{4}{9}$ — R

$\frac{3}{8}$ — R

$\frac{2}{8}$ — B

$\frac{3}{8}$ — Y ✓ $\frac{4}{9} \times \frac{3}{8} = \frac{12}{72}$

$\frac{2}{9}$ — B

$\frac{4}{8}$ — R

$\frac{1}{8}$ — B

$\frac{3}{8}$ — Y ✓ $\frac{2}{9} \times \frac{3}{8} = \frac{6}{72}$

$\frac{3}{9}$ — Y

$\frac{4}{8}$ — R ✓ $\frac{3}{9} \times \frac{4}{8} = \frac{12}{72}$

$\frac{2}{8}$ — B ✓ $\frac{3}{9} \times \frac{2}{8} = \frac{6}{72}$

$\frac{2}{8}$ — Y ✓ $\frac{3}{9} \times \frac{2}{8} = \frac{6}{72}$

$$\text{Prob (At least 1 yellow)} = \frac{12+6+12+6+6}{72}$$

$$= \frac{42}{72}$$
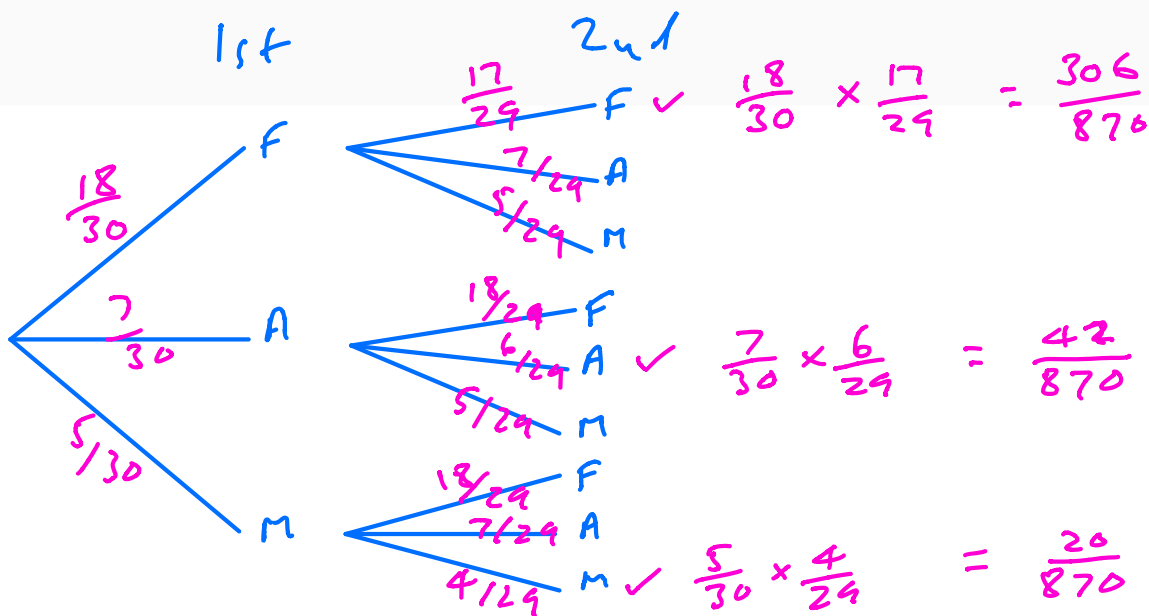
---

19. Nomusa has 30 sweets.

She has
   18 fruit sweets
   7 aniseed sweets
   5 mint sweets

Nomusa is going to take at random two sweets.

Work out the probability that the two sweets will **not** be the same type of sweet.
You must show all your working.

1st   2nd

$\frac{18}{30}$ F

$\frac{7}{30}$ A

$\frac{5}{30}$ M

$\frac{17}{29}$ — F ✓ $\frac{18}{30} \times \frac{17}{29} = \frac{306}{870}$

$\frac{7}{29}$ — A

$\frac{5}{29}$ — M

$\frac{18}{29}$ — F

$\frac{6}{29}$ — A ✓ $\frac{7}{30} \times \frac{6}{29} = \frac{42}{870}$

$\frac{5}{29}$ — M

$\frac{18}{29}$ — F

$\frac{7}{29}$ — A

$\frac{4}{29}$ — M ✓ $\frac{5}{30} \times \frac{4}{29} = \frac{20}{870}$

Prob (Not the same) = 1 − Prob(Same Colour)

$$= 1 - \left(\frac{306 + 42 + 20}{870} \right)$$

$$= 1 - \frac{368}{870}$$

$$= \frac{870}{870} - \frac{368}{870} = \frac{502}{870}$$