P31- Probability And and Or Rules

OCR

14 Adam has 10 sweets in a bag.
5 are cherry sweets, 4 are lemon sweets and 1 is an orange sweet.

Adam chooses a sweet at random from the bag and eats it.
He then takes another sweet at random from the bag and eats it.

(a) Adam says

P31

The probability that I choose two cherry sweets is $\frac{25}{100}$.

He is incorrect. Explain his error.

.....

..... **[2]**

(b) Find the probability that the two sweets he chooses have different flavours.

P33

(b) ..... **[4]**

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and = x
or = +

Ch Le O
5 4 1

14 Adam has 10 sweets in a bag.
5 are cherry sweets, 4 are lemon sweets and 1 is an orange sweet.

Adam chooses a sweet at random from the bag and eats it.
He then takes another sweet at random from the bag and eats it.

(a) Adam says

P31

The probability that I choose two cherry sweets is $\frac{25}{100}$.

He is incorrect. Explain his error.

Adam did $\frac{5}{10} \times \frac{5}{10} = \frac{25}{100}$ x

$\frac{5}{10}$ and $\frac{4}{9} = \frac{20}{90} = \frac{2}{9}$ ✓

..... [2]

(b) Find the probability that the two sweets he chooses have different flavours.

P33

(Ch and L) or (Ch and Or) or (L and C) or (L and O) or (O and C) or (O and L)

$\left(\frac{5}{10} \times \frac{4}{9}\right) + \left(\frac{5}{10} \times \frac{1}{9}\right) + \left(\frac{4}{10} \times \frac{5}{9}\right) + \left(\frac{4}{10} \times \frac{1}{9}\right) + \left(\frac{1}{10} \times \frac{5}{9}\right) + \left(\frac{1}{10} \times \frac{4}{9}\right)$

$\frac{20}{90} + \frac{5}{90} + \frac{20}{90} + \frac{4}{90} + \frac{5}{90} + \frac{4}{90}$

(b) ..... $\frac{58}{90}$ ..... [4]

Edexcel

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26 When a drawing pin is dropped it can land point down or point up.

Lucy, Mel and Tom each dropped the drawing pin a number of times.

The table shows the number of times the drawing pin landed point down and the number of times the drawing pin landed point up for each person.

	Lucy	**Mel**	**Tom**
point down	31	53	16
point up	14	27	9

Rachael is going to drop the drawing pin once.

(a) Whose results will give the best estimate for the probability that the drawing pin will land point up?
Give a reason for your answer.

Stuart is going to drop the drawing pin twice.

(b) Use all the results in the table to work out an estimate for the probability that the drawing pin will land point up the first time and point down the second time.

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26 When a drawing pin is dropped it can land point down or point up.

Lucy, Mel and Tom each dropped the drawing pin a number of times.

The table shows the number of times the drawing pin landed point down and the number of times the drawing pin landed point up for each person.

	Lucy	**Mel**	**Tom**
point down	31	53	16
point up	14	27	9

Total
100
50
150

Rachael is going to drop the drawing pin once.

(a) Whose results will give the best estimate for the probability that the drawing pin will land point up?
Give a reason for your answer. Mel, because she has had most trials

Stuart is going to drop the drawing pin twice.

(b) Use all the results in the table to work out an estimate for the probability that the drawing pin will land point up the first time and point down the second time.

$$\frac{50}{150} \times \frac{100}{150} = \frac{2}{9}$$ ✓

Video created by W Neill

21 There are only red counters, yellow counters and blue counters in a bag.

Kevin takes at random a counter from the bag.
He puts the counter back in the bag.
Lethna takes at random a counter from the bag.
She puts the counter back in the bag.

The probability that both counters are red or that both counters are yellow is $\frac{13}{36}$

The probability that the first counter is red and the second counter is not red is $\frac{1}{4}$

Seb takes at random a counter from the bag.

Work out the probability that Seb takes a yellow counter.
You must show all your working.

.....

(Total for Question 21 is 5 marks)

Video created by W Neill

21 There are only red counters, yellow counters and blue counters in a bag.

P31 A45 Kevin takes at random a counter from the bag.
He puts the counter back in the bag.
Lethna takes at random a counter from the bag.
She puts the counter back in the bag.

Red = x

Yellow = y

The probability that both counters are red or that both counters are yellow is $\frac{13}{36}$

The probability that the first counter is red and the second counter is not red is $\frac{1}{4}$

Seb takes at random a counter from the bag.

Work out the probability that Seb takes a yellow counter.
You must show all your working.

Red and Not Red = 1/4

$x \times (1-x) = 1/4$

$x(1-x) = 1/4$

$x - x^2 = 1/4$

Red and Red or Yellow and Y

$(x \times x) + (y \times y) = 13/36$ or $= 13/36$

$x^2 + y^2 = 13/36$

.....

(Total for Question 21 is 5 marks)

$x^2 + y^2 = \frac{13}{36}$

$4ac$

$4 \times -1 \times -\frac{1}{4}$

$+1$

$x - x^2 = \frac{1}{4}$

$ax^2 + bx + c = 0$

$-x^2 + 1x - \frac{1}{4} = 0$

$a = -1$

$b = 1$

$c = -\frac{1}{4}$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-1 \pm \sqrt{1 - 1}}{-2}$$

$$x = \frac{-1 \pm 0}{-2} = \frac{-1}{-2} = \frac{1}{2}$$

$x = \frac{1}{2}$

$x^2 + y^2 = \frac{13}{36}$

$\left(\frac{1}{2}\right)^2 + y^2 = \frac{13}{36}$

$\frac{1}{4} + y^2 = \frac{13}{36}$

$y^2 = \frac{13}{36} - \frac{1}{4}$

$y^2 = \frac{1}{9}$

$y = \sqrt{\frac{1}{9}}$

$y = \frac{1}{3}$ ✓

yellow

21 There are 12 counters in a bag.
There is an equal number of red counters, blue counters and yellow counters in the bag.
There are no other counters in the bag.

3 counters are taken at random from the bag.

(a) Work out the probability of taking 3 red counters.

.....

(2)

21 There are 12 counters in a bag.
There is an equal number of red counters, blue counters and yellow counters in the bag.
There are no other counters in the bag.

3 counters are taken at random from the bag.

(a) Work out the probability of taking 3 red counters.

R : B : Y

4 : 4 : 4

Red and Red and Red

$\frac{4}{12} \times \frac{3}{11} \times \frac{2}{10} = \frac{24}{1320} = \frac{1}{55} = 0.018$

(2)

The 3 counters are put back into the bag.

Some more counters are now put into the bag.
There is still an equal number of red counters, blue counters and yellow counters in the bag.
There are no counters of any other colour in the bag.

3 counters are taken at random from the bag.

(b) Is it now less likely or equally likely or more likely that the 3 counters will be red?
You must show how you get your answer.

(2)

(Total for Question 21 is 4 marks)

The 3 counters are put back into the bag.

Some more counters are now put into the bag.
There is still an equal number of red counters, blue counters and yellow counters in the bag.
There are no counters of any other colour in the bag.

3 counters are taken at random from the bag.

(b) Is it now less likely or equally likely or more likely that the 3 counters will be red?
You must show how you get your answer.

R : B : Y

1 extra of each goes in

5 : 5 : 5

More likely as

0·0219 > 0·018 ✓

Red x Red x Red

$\frac{5}{15} \times \frac{4}{14} \times \frac{3}{13} = \frac{2}{91} = 0.0219$

(2)

(Total for Question 21 is 4 marks)

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20 50 people were asked if they speak French or German or Spanish.

Of these people,

P28
P31

31 speak French
2 speak French, German and Spanish
4 speak French and Spanish but not German
7 speak German and Spanish
8 do not speak any of the languages
all 10 people who speak German speak at least one other language

Two of the 50 people are chosen at random.

Work out the probability that they both only speak Spanish.

.....

(Total for Question 20 is 5 marks)

20 50 people were asked if they speak French or German or Spanish.

Video created by W Neill

Of these people,

31 speak French

P28 ~~2 speak French, German and Spanish~~ ✓

P31 ~~4 speak French and Spanish but not German~~ ✓

~~7 speak German and Spanish~~ ✓

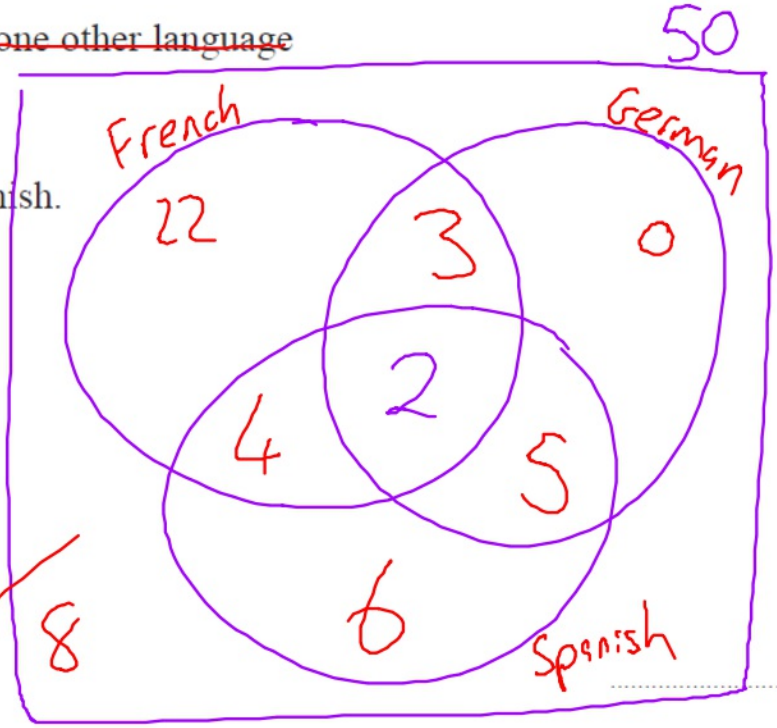
~~8 do not speak any of the languages~~

~~all 10 people who speak German speak at least one other language~~

31 - 9 = 22

Two of the 50 people are chosen at random.

Work out the probability that they both only speak Spanish.



Pick 1 and Pick 2nd

$\frac{6}{50} \times \frac{5}{49} = \frac{3}{245}$

(Total for Question 20 is 5 marks)

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

A54 There are three more blue pens than green pens in the box.

P31 There are more than 12 pens in the box.

P33 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.

.....

(Total for Question 22 is 6 marks)

Video Created by W Neill

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

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

A54 There are more than 12 pens in the box.

P31 Simon is going to take at random two pens from the box.

P33 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.

→ green = x
blue = $x+3$
} Total $2x+3$

green & green or blue and blue

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

$$\frac{x^2-x}{4x^2+10x+6}+\frac{x^2+5x+6}{4x^2+10x+6}=\frac{27}{55}$$

$(2x+3)(2x+2)$

$4x^2+4x+6x+6$

$4x^2+10x+6$

$(x+3)(x+2)$

x^2+5x+6

$55(2x^2+14x+6)=27(4x^2+10x+6)$

$110x^2+220x+330=108x^2+270x+162$

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

$110x^2-108x^2+220x-270x+330-162=0$

$2x^2-50x+168=0$

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

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

$x=21$
$x=4$

21 ✓

(Total for Question 22 is 6 marks)

16 There are only red counters and blue counters in a bag.

P31 Joe takes at random a counter from the bag.
P32 The probability that the counter is red is 0.65
Joe puts the counter back into the bag.

Mary takes at random a counter from the bag.
She puts the counter back into the bag.

(a) What is the probability that Joe and Mary take counters of different colours?

.....

(2)

16 There are only red counters and blue counters in a bag.

P31 Joe takes at random a counter from the bag.
P32 The probability that the counter is red is 0.65
Joe puts the counter back into the bag.

Mary takes at random a counter from the bag.
She puts the counter back into the bag.

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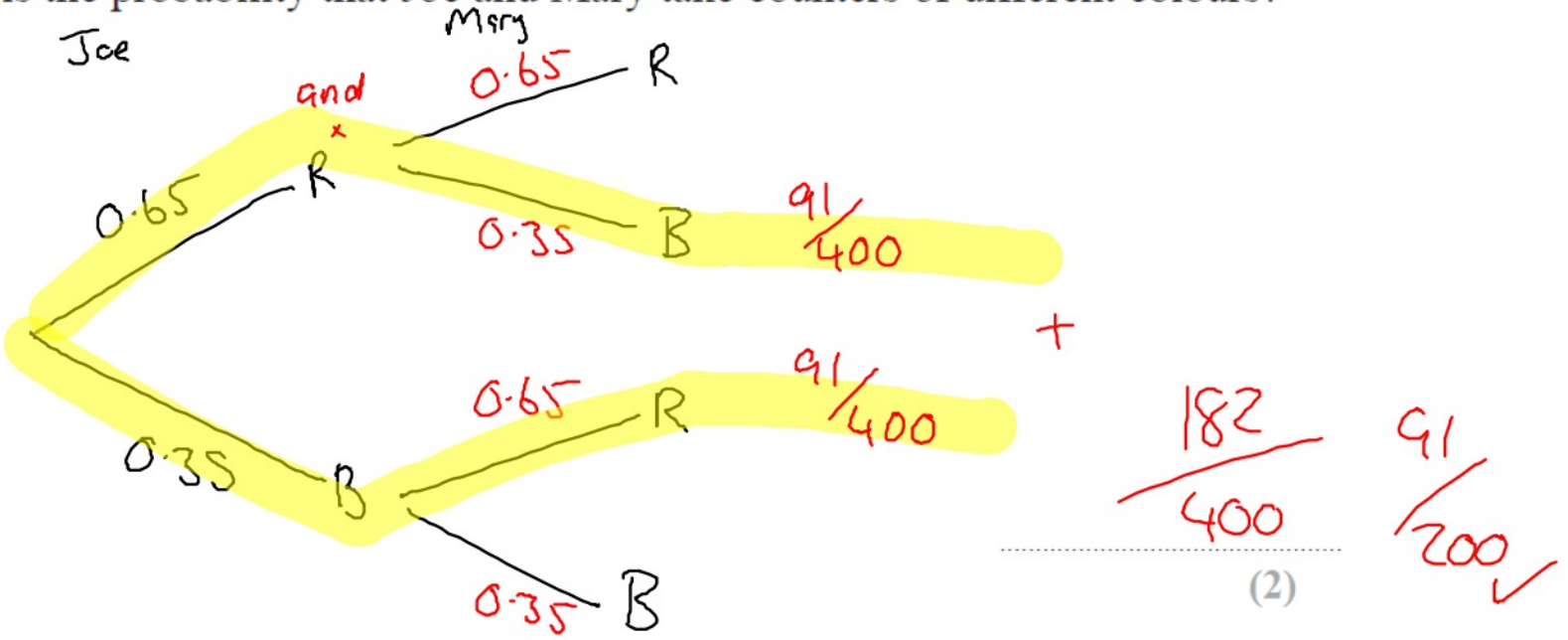

(2)

There are 78 red counters in the bag.

(b) How many blue counters are there in the bag?

.....

(2)

There are 78 red counters in the bag.

(b) How many blue counters are there in the bag?

0·35

÷13 ↓ 0·65 = 78 counters

0·05 =

×7 ↓ 0·35 = 42

42

(2)

AQA

18 A bag contains 20 discs.

10 are red, 7 are blue and 3 are green.

P31

18 (a) Marnie takes a disc at random before putting it back in the bag.

Nick then takes a disc at random before putting it back in the bag.

Olly then takes a disc at random.

Work out the probability that they all take a red disc.

[2 marks]

Answer _____

Video created by W Neill

18 A bag contains 20 discs.

P31 10 are red, 7 are blue and 3 are green.

18 (a) Marnie takes a disc at random before putting it back in the bag.

Nick then takes a disc at random before putting it back in the bag.

Olly then takes a disc at random.

Work out the probability that they all take a red disc.

[2 marks]

R and R and R

$\frac{10}{20} \times \frac{10}{20} \times \frac{10}{20}$

$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$

$= \frac{1}{8}$

Answer $\frac{1}{8}$

18 (b) All 20 discs are in the bag.

Reggie takes three discs at random, one after the other.

After he takes a disc he does **not** put it back in the bag.

Reggie's first disc is blue.

Work out the probability that all three discs are different colours.

[3 marks]

Answer _____

Video created by W Neill

18 (b) All 20 discs are in the bag.

Reggie takes three discs at random, one after the other.

After he takes a disc he does **not** put it back in the bag.

10 Red
7 blue
3 Green

Reggie's first disc is blue.

Work out the probability that all three discs are different colours.

[3 marks]

B (R G) $\frac{7}{20}$ ($\frac{10}{19} \times \frac{3}{18}$) or + B (G R) ($\frac{3}{19} \times \frac{10}{18}$)

$\frac{5}{57} + \frac{5}{57}$

Answer $\frac{10}{57}$ ✓

Video created by W Neill

16 In a running club there are 50 females and 80 males.

If a female is chosen at random, the probability she has blue eyes is 0.38

P31

If a male is chosen at random, the probability he has blue eyes is 0.6

One person is chosen at random.

Show that the probability the person has blue eyes is **more than** 0.5

[4 marks]

Video created by W Neill

16 In a running club there are 50 females and 80 males.

If a female is chosen at random, the probability she has blue eyes is 0.38

P31

If a male is chosen at random, the probability he has blue eyes is 0.6

One person is chosen at random.

Show that the probability the person has blue eyes is **more than** 0.5

[4 marks]

(female and blue) or (Male and blue)

$\left(\frac{50}{130} \times 0.38\right) + \left(\frac{80}{130} \times 0.6\right)$

$\frac{67}{130}$

$\frac{67}{130} > \frac{1}{2}$

as $\frac{65}{130} = \frac{1}{2}$

✓