Probability 2 (H)

A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas.

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Total Marks:	

1. Andy sometimes gets a lift to and from college.

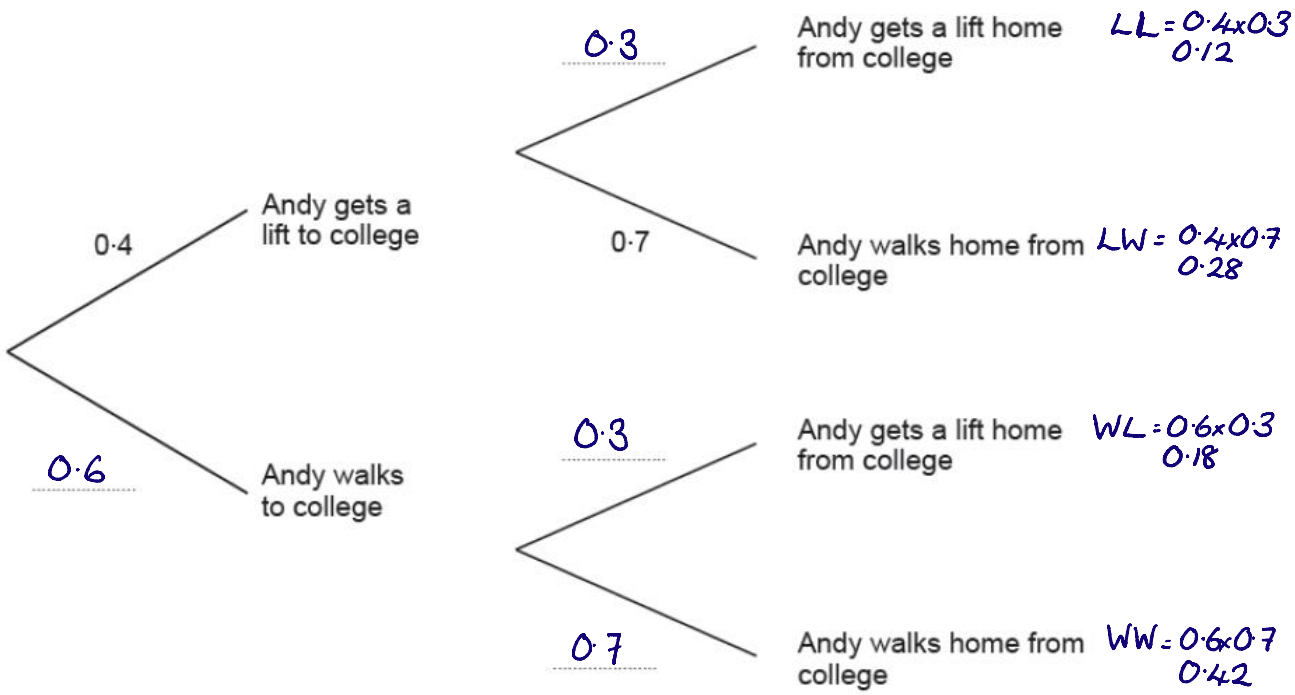
   When he does not get a lift he walks.

   The probability that he gets a lift to college is 0·4.

   The probability that he walks home from college is 0·7.

   Getting to college and getting home from college are independent events.

(a) Complete the following tree diagram.



[2]

(b) Calculate the probability that Andy gets a lift to college and walks home from college

P(lift, walk) = 0·28

[2]

(c) Calculate the probability that Andy does not get a lift to or from college.

P(no lift) = 0·42

[2]

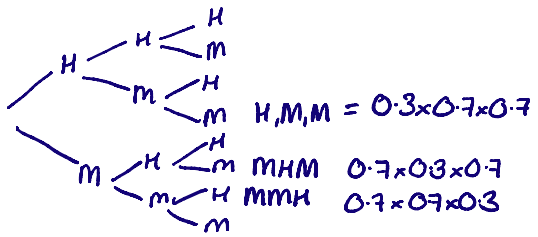
2. (a) When Kayla shoots an arrow, the probability that she hits the target is 0·3.
Each attempt is independent of any previous shot.

(i) What is the probability that she hits the target for the first time on her third attempt?

P(Hit) = 0·3 P(miss) = 0·7
P(M,M,H) : 0·7×0·7×0·3 = 0·147

[2]

(ii) Check whether or not there is more than a 50% chance of Kayla hitting the target once only on her first three attempts.



3×0·147
= 0·441 = 44·1%
There is not more than 50% chance

[3]

(b) (i) A fairground game consists of removing two balls at random from a box containing 15 blue balls and 5 red balls.
A player wins the game if two red balls are removed.
John calculates that the probability of winning the game is

$$\left(\frac{1}{4}\right)^2 = \frac{1}{16}$$

What assumption has John made for his answer to be correct?

he has assumed the ball is replaced so that the probability the 2nd time is the same as the first time

[1]

ii) If John's assumption was not true, what effect would this have on the probability of winning the game?

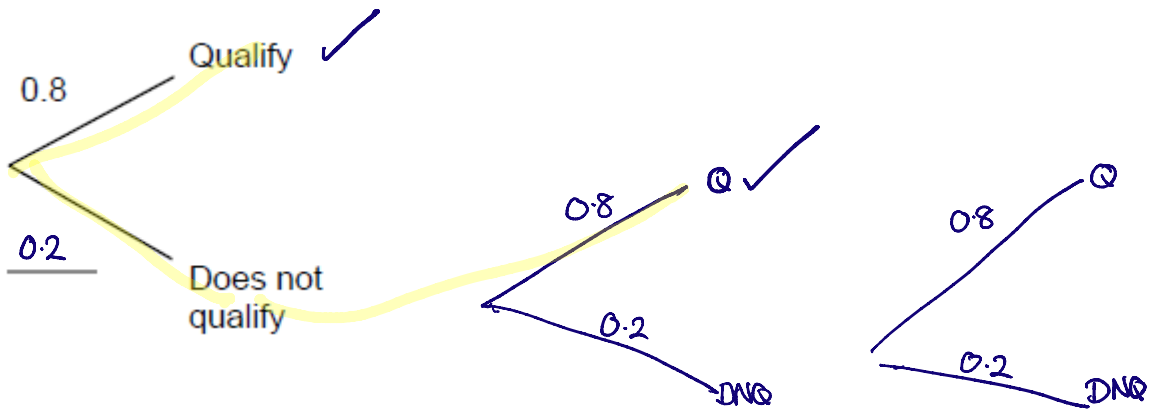
$\frac{1}{4} \times \frac{4}{19} = \frac{1}{19}$

The probability is reduced.

[1]

3. On Friday, Greg takes part in a long jump competition.
He has to jump at least 7.5 metres to qualify for the final on Saturday.
He has up to three jumps to qualify.
If he jumps at least 7.5 metres he does not jump again on Friday.
Each time Greg jumps, the probability he jumps at least 7.5 metres is 0.8
Assume each jump is independent.

(a) Complete the tree diagram.



[2]

(b) Work out the probability that he does not need the third jump to qualify.

$0.8 + (0.2 \times 0.8)$

$0.8 + 0.16 = 0.96$

[2]

4. John has an empty box.
He puts some red counters and some blue counters into the box.

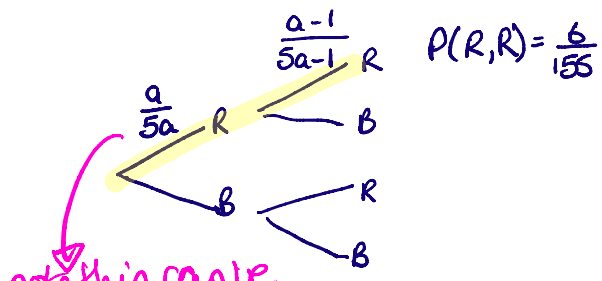
The ratio of the number of red counters to the number of blue counters is 1 : 4

Linda takes at random 2 counters from the box.

The probability that she takes 2 red counters is $\frac{6}{155}$

How many red counters did John put into the box?

a b
so $b = 4a$
$a : 4a$



$P(R,R) = \frac{6}{155}$

note this could be written as $\frac{1}{3}$ which will simplify the algebra here

to check. $\frac{25}{125} \times \frac{24}{124} = \frac{600}{15500} = \frac{6}{155}$

John put 25 counters in the bag.

assuming the first red is not replaced

$\frac{a}{5a} \times \frac{a-1}{5a-1} = \frac{6}{155}$

$\frac{a(a-1)}{5a(5a-1)} = \frac{6}{155}$ $\quad \frac{a^2-a}{25a^2-5a} = \frac{6}{155}$

$155a^2 - 155a = 6(25a^2 - 5a)$

$155a^2 - 155a = 150a^2 - 30a$

$155a^2 - 150a^2 - 155a + 30a = 0$

$5a^2 - 125a = 0$

$5a(a - 25) = 0$

$a = 0$ (×) or $a = 25$ (✓)

[4]

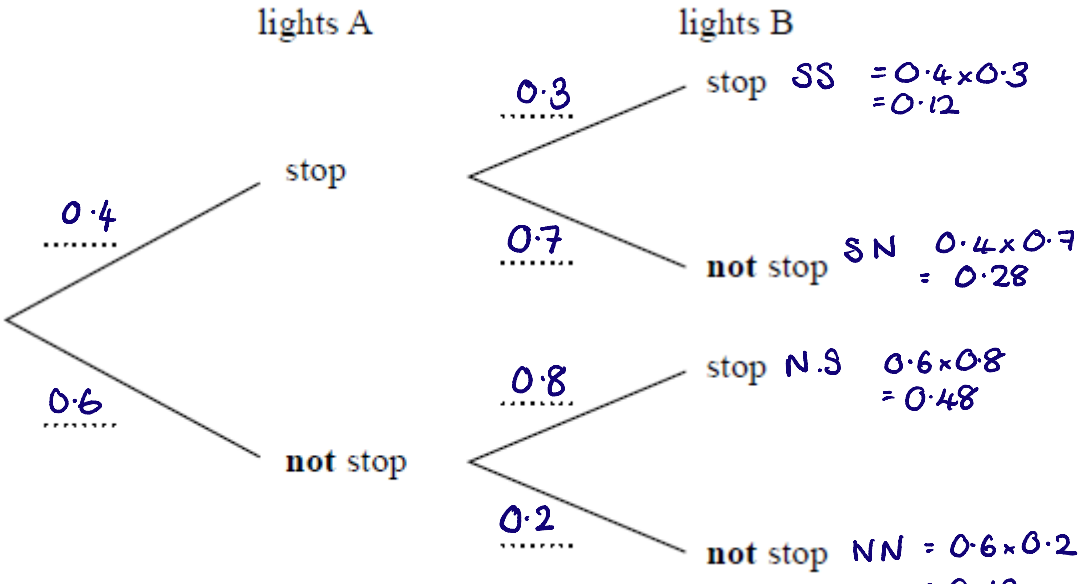
5. A and B are two sets of traffic lights on a road.

The probability that a car is stopped by lights A is 0.4

If a car is stopped by lights A, then the probability that the car is not stopped by lights B is 0.7

If a car is not stopped by lights A, then the probability that the car is not stopped by lights B is 0.2

(a) Complete the probability tree diagram for this information.



[2]

Mark drove along this road.

He was stopped by just one of the sets of traffic lights.

(b) Is it more likely that he was stopped by lights A or by lights B?

You must show your working.

$P(S.N) = 0.28$

$P(N.S) = 0.48$

it is more likely that he was stopped by lights B

[3]

6. A bag contains only red and blue marbles.

Yasmine takes one marble at random from the bag.

The probability that she takes a red marble is $\frac{1}{5}$.

$R = \frac{1}{5} = a$

$B = \frac{4}{5} = 4a$

Yasmine returns the marble to the bag and adds five more red marbles to the bag.

The probability that she takes one red marble at random is now $\frac{1}{3}$.

How many marbles of each colour were originally in the bag?

start
R: a
B: 4a
Total = 5a

+5 Red

2nd time
R = a + 5

Total = 5a + 5

$P(RR) = \frac{a+5}{5a+5} = \frac{1}{3}$

$3a + 15 = 5a + 5$

$10 = 2a$

$a = 5$

so number of Blue $= 4 \times 5 = 20$

5 ..... red marbles

20 ..... blue marbles

[3]

7. A bag contains counters that are red, blue, green or yellow.

	red	blue	green	yellow
Number of counters	9	$3x$	$x - 5$	$2x$

48 11 32

A counter is chosen at random.

The probability it is red is $\frac{9}{100}$

Work out the probability it is green.

$3x + x - 5 + 2x + 9 = 100$

$6x + 4 = 100$

$6x = 96$

$x = 96/6$

$x = 16$

$6 \overline{)96}$ $= 16$

$P(\text{Green}) = \frac{11}{100}$

[4]

8. Bag X contains 9 blue balls and 18 red balls.

Bag Y contains 7 blue balls and 14 red balls.

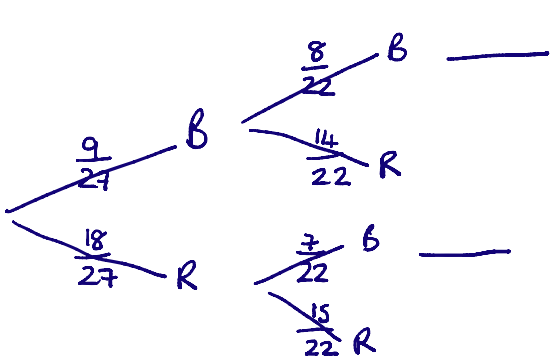
Liz picks a ball at random from bag X.

She puts the ball into bag Y.

Mike now picks a ball at random from bag Y.

Show that

P (Liz picks a blue ball) = P (Mike picks a blue ball)



$P(BB) = \frac{9}{27_3} \times \frac{8}{22_{11}}^{4} = \frac{4}{33}$

$P(RB) = \frac{18}{27_3}^{2} \times \frac{7}{22_{11}} = \frac{7}{33}$

P(Mike picking a blue) $= \frac{4}{33} + \frac{7}{33} = \frac{11}{33} = \frac{1}{3}$

P(Liz picking a blue) $= \frac{9}{27} = \frac{1}{3}$ ← the same probability

[4]

9. Some of the children at a nursery arrive by car.

40% of the children at the nursery are boys.

70% of the boys at the nursery arrive by car.

60% of the girls at the nursery arrive by car.

What is the probability that a child chosen at random from the nursery arrives by car?

	B	G	Total
Car	28	36	64
Not car	12	24	36
Total	40%	60%	100

70% of 40: $\frac{70}{100} \times 40$

60% of 60: $\frac{60}{100} \times 60$

$P(car) = \frac{64}{100}$

..... [5]

10. Four friends each throw a biased coin a number of times.

The table shows the number of heads and the number of tails each friend got.

	Ben	Helen	Paul	Sharif
heads	34	66	80	120
tails	8	12	40	40

The coin is to be thrown one more time.

(a) Which of the four friends' results will give the best estimate for the probability that the coin will land heads?

Justify your answer.

Sharif as he threw the coin the most times.

[1]

Paul says: *"With this coin you are twice as likely to get heads as to get tails."*

(b) Is Paul correct? Justify your answer.

he is correct for his results. $P(H) = \frac{80}{120}$ $P(T) = \frac{40}{120}$ BUT overall $P(H) = \frac{300}{400} = \frac{3}{4}$ $P(T) = \frac{100}{400} = \frac{1}{4}$

$P(H) = P(T) \times 2$ $P(H) = 3 \times P(T)$ [2]

The coin is to be thrown twice.

(c) Use all the results in the table to work out an estimate for the probability that the coin will land heads both times.

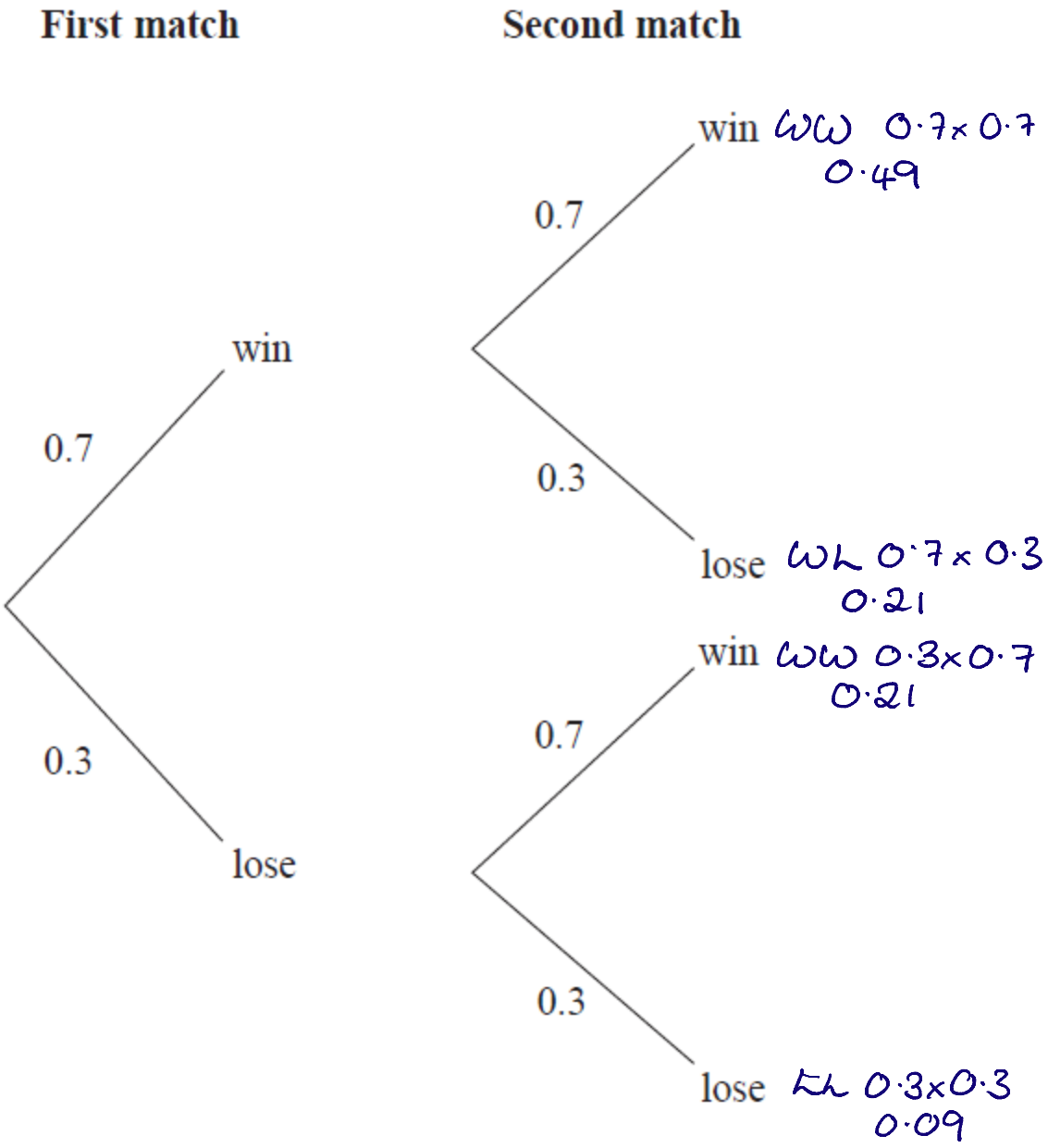
$\frac{3}{4} \times \frac{3}{4} =$

$\frac{9}{16}$

..... [2]

11. Finlay plays two tennis matches.

The probability that he will win a match and the probability that he will lose a match are shown in the probability tree diagram.



a) Work out the probability that Finlay wins both matches.

$P(WW) = 0.49$ ..... [2]

b) Work out the probability that Finlay loses at least one match.

W L, L W, L L

0·21 0·21 0·09

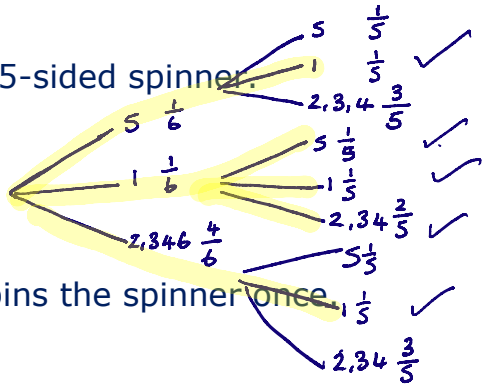
0·51 ..... [2]

12. David has designed a game.

He uses a fair 6-sided dice and a fair 5-sided spinner.

The dice is numbered 1 to 6

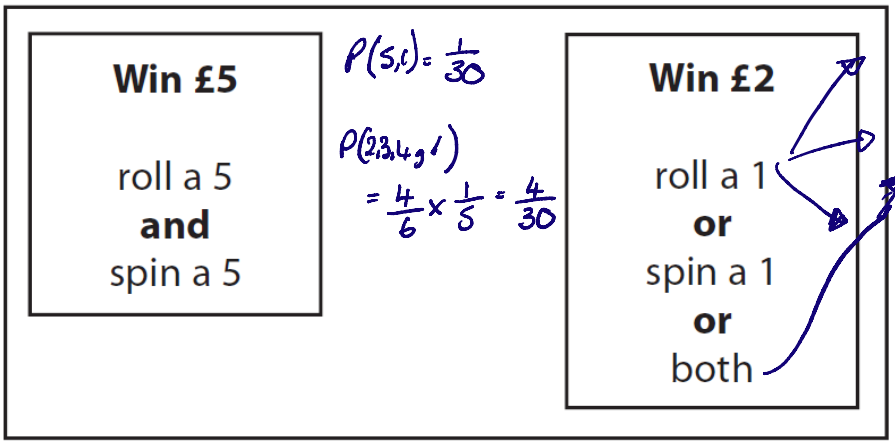
The spinner is numbered 1 to 5



Each player rolls the dice once and spins the spinner once.

A player can win £5 or win £2

$P(5,5) = \frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$ so 1 × £5 paid out



$P(5,1) = \frac{1}{30}$

$P(2,3,4,1) = \frac{4}{6} \times \frac{1}{5} = \frac{4}{30}$

$P(1,5) = \frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$

$P(1,1) = \frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$

$P(1,[2,3,4]) = \frac{1}{6} \times \frac{2}{5} = \frac{2}{30}$

David expects 30 people will play his game.

Each person will pay David £1 to play the game. } 30 × £1 = £30

(a) Work out how much profit David can expect to make.

$P(£2) = \frac{1}{30} + \frac{4}{30} + \frac{1}{30} + \frac{1}{30} + \frac{2}{30} = \frac{9}{30}$ so 9 × £2 paid out = £18

Pays out 18 + 5 = £23

Profit = 30 − 23

£ 7 .....[4]

(b) Give a reason why David's actual profit may be different to the profit he expects to make.

the dice or the spinner may not be fair.

.....[1]

13 The probability that Sanay is late for school tomorrow is 0.05

The probability that Jaden is late for school tomorrow is 0.15

Alfie says that the probability that Sanay and Jaden will both be late for school tomorrow is 0.0075 because 0.05 × 0.15 = 0.0075

What assumption has Alfie made?

he has assumed the probabilities are independent

[1]

14 Thelma spins a biased coin twice.

The probability that it will come down heads both times is 0.09

Calculate the probability that it will come down tails both times.

$P(H,H) = 0.09$ so $P(H) = 0.3$ $(0.3 \times 0.3 = 0.09)$

$P(T) = 0.7$

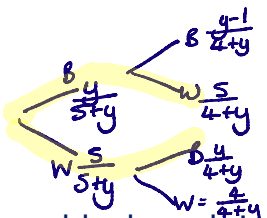
$P(T,T) = 0.7 \times 0.7 = 0.49$

[3]

15 There are y black socks and 5 white socks in a drawer.

Joshua takes at random two socks from the drawer.

The probability that Joshua takes one white sock and one black sock is $\frac{6}{11}$



a) Show that $3y^2 - 28y + 60 = 0$

$P(BW) = \frac{y}{5+y} \times \frac{5}{4+y}$

$P(WB) \frac{5}{5+y} \times \frac{y}{4+y}$

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

$10y \times 11 = 6(20 + 5y + 4y + y^2)$

$110y = 120 + 54y + 6y^2$

$6y^2 - 56y + 120 = 0$ $(\div 2)$ $3y^2 - 28y + 60 = 0$

[4]

b) Find the probability that Joshua takes two black socks.

$P(B,B) = \frac{y}{5+y} \times \frac{y-1}{4+y}$ NEED TO FIND y

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

$y = \frac{10}{3}$ or $y = 6$ ✓

$P(B,B) = \frac{6}{11} \times \frac{5}{10} = \frac{30}{110}$

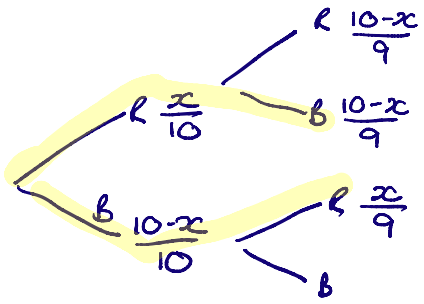
[3]

16. There are 10 pens in a box.

There are x red pens in the box.

All the other pens are blue. $10 - x$

Jack takes at random two pens from the box.



Find an expression, in terms of x, for the probability that Jack takes one pen of each colour.

Give your answer in its simplest form.

$P(R,B) = \frac{x}{10} \times \frac{10-x}{9} = \frac{10x - x^2}{90}$

$P(BR) = \frac{10-x}{10} \times \frac{x}{9} = \frac{10x - x^2}{90}$

$P(2 \text{ different colours}) = \frac{2(10x - x^2)}{90}$

$= \frac{10x - x^2}{45}$

[5]

17. A bag contains n beads.

One bead is black and the rest are white.

Two beads are taken from the bag at random.

$P(B) = \frac{1}{n}$ $P(W) = \frac{n-1}{n}$

a) Show that the probability that both beads are white is $\frac{n-2}{n}$

$P(W,W) = \frac{n-1}{n} \times \frac{n-2}{n-1} = \frac{(n-1)(n-2)}{n(n-1)} = \frac{n-2}{n}$

[2]

b) The probability that both beads are white is greater than 0.9

Work out the least possible value of n.

$\frac{n-2}{n} > 0.9$ $n-2 > 0.9n$

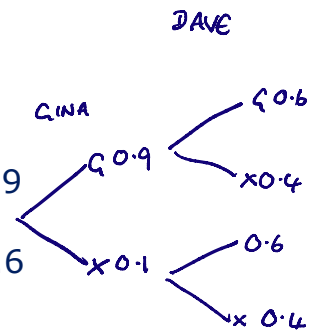
$0.1n > 2$

$n > 20$ so the least value is 21

[3]

18. The probability that Gina goes to the gym on Saturday is 0.9

The probability that Dave goes to the gym on Saturday is 0.6



These probabilities are independent.

a) Calculate the probability that both Gina and Dave go to the gym on Saturday.

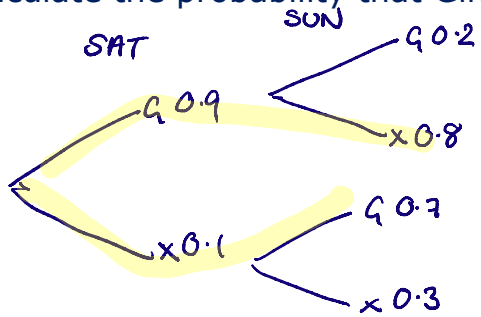
$P(G,G) = 0.9 \times 0.6 = 0.54$

[1]

b) If Gina goes to the gym on Saturday the probability that she goes on Sunday is 0.2

If Gina does not go to the gym on Saturday the probability that she goes on Sunday is 0.7

Calculate the probability that Gina goes to the gym on exactly one of the two days.



$P(\text{exactly one of 2 days}) = P(G\,X) + P(X\,G)$

$= 0.9 \times 0.8 + 0.1 \times 0.7$

$= 0.72 + 0.07$

$= 0.79$

[4]

CREDITS AND NOTES

Question	Awarding Body	Question	Awarding Body
1	WJEC Eduqas	11	Pearson Edexcel
2	WJEC Eduqas	12	Pearson Edexcel
3	AQA	13	Pearson Edexcel
4	Pearson Edexcel	14	Pearson Edexcel
5	Pearson Edexcel	15	Pearson Edexcel
6	OCR	16	Pearson Edexcel
7	AQA	17	AQA
8	AQA	18	AQA
9	OCR		
10	Pearson Edexcel		

Notes:

These questions have been retyped from the original sample/specimen assessment materials and whilst every effort has been made to ensure there are no errors, any that do appear are mine and not the exam board s (similarly any errors I have corrected from the originals are also my corrections and not theirs!).

Please also note that the layout in terms of fonts, answer lines and space given to each question does not reflect the actual papers to save space.

These questions have been collated by me as the basis for a GCSE working party set up by the GLOW maths hub - if you want to get involved please get in touch. The objective is to provide support to fellow teachers and to give you a flavour of how different topics "could" be examined. They should not be used to form a decision as to which board to use. There is no guarantee that a topic will or won't appear in the "live" papers from a specific exam board or that examination of a topic will be as shown in these questions.

Links:

AQA http://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300

OCR http://ocr.org.uk/gcsemaths

Pearson Edexcel http://qualifications.pearson.com/en/qualifications/edexcel-gcses/mathematics-2015.html

WJEC Eduqas http://www.eduqas.co.uk/qualifications/mathematics/gcse/

Contents:

This version contains questions from:

AQA – Sample Assessment Material, Practice set 1 and Practice set 2

OCR – Sample Assessment Material and Practice set 1

Pearson Edexcel – Sample Assessment Material, Specimen set 1 and Specimen set 2

WJEC Eduqas – Sample Assessment Material