EQUITY
LEARNING PLACE

Elementary Math Topical (Probability)

Question 1:

A bag contains 5 cards, numbered 4, 5, 7, 8 and 9. Two cards are picked at random, one at a time without replacement.

a) Draw a possibility diagram to show all the possible outcomes.

b) Find the probability that

i) both numbers are odd

ii) the sum of the numbers is less than 10

iii) the product of the numbers is a perfect square

a)

	4	5	7	8	9
4	–	(5,4)	(7,4)	(8,4)	(9,4)
5	(4,5)	–	(7,5)	(8,5)	(9,5)
7	(4,7)	(5,7)	–	(8,7)	(9,7)
8	(4,8)	(5,8)	(7,8)	–	(9,8)
9	(4,9)	(5,9)	(7,9)	(8,9)	–

bi) $\mathrm{P(both\ odd)} = \frac{3}{5} \times \frac{2}{4} = \frac{3}{10}$

bii) $\mathrm{P(sum\ is\ less\ than\ 10)} = \frac{1}{10}$

biii) $\mathrm{P(product\ is\ perfect\ square)} = \frac{1}{10}$

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Question 2:

Jack takes a Mathematics test repeatedly until he passes. Each time Jack takes the test, the probability that he passes is $\frac{3}{5}$. Find the probability that Jack

a) passes only at the third attempt

b) passes in one of the first three attempts.

a) $\text{P(pass at 3rd attempt)} = \frac{2}{5} \times \frac{2}{5} \times \frac{3}{5} = \frac{12}{125}$

b) $\text{P(pass in one of the three attempt)} = 1 - \text{P(fail all first three attempt)} = 1 - \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} = \frac{117}{125}$

Elementary Math Topical (Probability)

Question 3:

A box contains 6 ping pong balls, numbered 2, 3, 4, 5, 11 and 13. Two balls are picked at random from the box, one at a time without replacement.

a) Draw a possibility diagram to represent the outcomes.

Find the probability that

b) both balls are prime numbered.

c) the sum of numbers on both balls is at least 15.

d) the product of numbers on both balls is not more than 50.

a)

	2	3	4	5	11	13
2	–	(3,2)	(4,2)	(5,2)	(11,2)	(13,2)
3	(2,3)	–	(4,3)	(5,3)	(11,3)	(13,3)
4	(2,4)	(3,4)	–	(5,4)	(11,4)	(13,4)
5	(2,5)	(3,5)	(4,5)	–	(11,5)	(13,5)
11	(2,11)	(3,11)	(4,11)	(5,11)	–	(13,11)
13	(2,13)	(3,13)	(4,13)	(5,13)	(11,13)	–

b) $\mathrm{P(both\ primed\ number)} = \frac{5}{6} \times \frac{4}{5} = \frac{2}{3}$

c) $\mathrm{P(sum\ is\ at\ least\ 15)} = \frac{7}{15}$

d) $\mathrm{P(product\ is\ not\ more\ than\ 50)} = \frac{11}{15}$

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Question 4:

Green and yellow ping pong balls are placed in a box. Each coloured ball has a symbol marked either "X" or "O" on it. The table below shows the probabilities of selecting a ball randomly from the box.

	Green	Yellow
X	p	$\frac{1}{8}$
O	$\frac{1}{6}$	$\frac{1}{3}$

a) Find the probability p of randomly selecting a green "X" ball.

There are 9 yellow "X" balls altogether.

b) Find the number of green "O" balls.

Two balls are selected randomly from the box together.

c) Find the probability that both balls are yellow.

a) $p = 1 - \frac{1}{8} - \frac{1}{6} - \frac{1}{3} = \frac{3}{8}$

b) $\frac{1}{8}$ of all the balls $\rightarrow$ 9 balls

Total number of balls $= 9 \times 8 = 72$

Number of green "O" balls $= \frac{1}{6} \times 72 = 12$

c) Total yellow balls $= \left(\frac{1}{3} + \frac{1}{8}\right) \times 72 = 33$

P(both yellow ball) $= \frac{33}{72} \times \frac{32}{71} = \frac{44}{213}$

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Question 5:

Two fair dice are tossed and the number on each of the die is observed. The possibility diagram below shows the sample space.

First Die \ Second Die	1	2	3	4	5	6
1	(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
2	(2, 1)	(2, 2)	(2, 3)	(2, 4)	(2, 5)	(2, 6)
3	(3, 1)	(3, 2)	(3, 3)	(3, 4)	(3, 5)	(3, 6)
4	(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
5	(5, 1)	(5, 2)	(5, 3)	(5, 4)	(5, 5)	(5, 6)
6	(6, 1)	(6, 2)	(6, 3)	(6, 4)	(6, 5)	(6, 6)

Find the probability that

a) the sum of the numbers on the two dice is either less than 4 or more than 10.

b) either the sum of the numbers on the two dice is odd or one of the numbers observed is 6

a) $P(\text{less than 4 or more than 10}) = \frac{6}{36} = \frac{1}{6}$

b) $P(\text{either sum is odd or one number is 6}) = \frac{23}{36}$

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Question 6:

A bag contains 6 green marbles and 8 blue marbles. If a green marble is drawn, it is not replaced. If a blue marble is drawn, it is replaced and an additional blue marble is added into the bag. Two marbles are now drawn at random from the bag, one at a time.

a) Draw a tree diagram to show the probabilities of the possible outcomes.

Find, as a fraction in its simplest form, the probability that

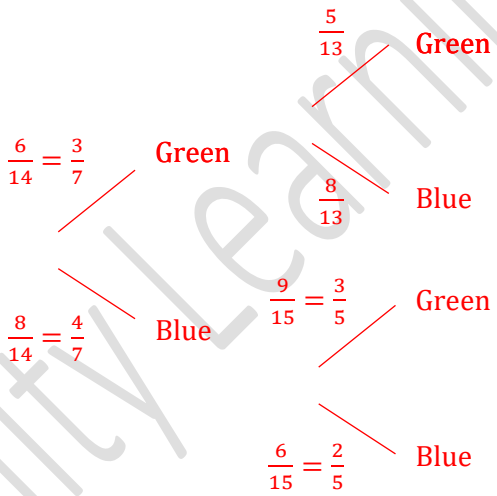
b) the two marbles drawn have different colours,

c) at least one of the marbles is blue.

A third marble is now drawn.

d) Find the probability that all three marbles have the same colour.

a)



b) $\mathrm{P(different\ colour)} = \frac{3}{7} \times \frac{8}{13} + \frac{4}{7} \times \frac{3}{5} = \frac{276}{455}$

c) $\mathrm{P(at\ least\ 1\ blue)} = 1 - \mathrm{P(no\ blue)} = 1 - \frac{3}{7} \times \frac{5}{13} = \frac{76}{91}$

d) $\mathrm{P(all\ same\ colour)} = \frac{3}{7} \times \frac{5}{13} \times \frac{4}{12} + \frac{4}{7} \times \frac{3}{5} \times \frac{10}{16} = \frac{7}{26}$

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Question 7:

A bag contains balls of four different colours, namely, Red, Blue, Yellow and Green.
For each colour, there are six balls, each labelled '1', '2', '3', '4', '5' and '6'.

a) If a ball is drawn randomly from the bag, find the probability that it is

i) labelled '1',
ii) red.

b) If two balls are drawn in succession, find the probability that both balls are labelled '1'.

c) If three balls are drawn in succession, determine the probability that

i) at least one ball is labelled '5',
ii) all three balls are of the same colour.

ai) $\mathrm{P(labelled\ '1')} = \frac{1}{6}$

aii) $\mathrm{P(red)} = \frac{1}{4}$

b) $\mathrm{P(both\ labelled\ 1)} = \frac{4}{24} \times \frac{3}{23} = \frac{1}{46}$

c) $\mathrm{P(at\ least\ one\ ball\ is\ 5)} = 1 - \mathrm{P(no\ 5)} = 1 - \frac{20}{24} \times \frac{19}{23} \times \frac{18}{22} = \frac{221}{506}$

d) $\mathrm{P(all\ three\ same\ colour)} = \left[\frac{6}{24} \times \frac{5}{23} \times \frac{4}{22}\right] \times 4 = \frac{10}{253}$

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Question 8:

A bag contains some identical balls. 9 are red, 6 are blue and 5 are yellow. Two balls are taken from the bag without replacement. Find, as a fraction in its simplest form, the probability that

a) the two balls taken are of different colours.

b) If a third ball is taken, find the probability that all three balls are of different colours.

a) $\mathrm{P}(2 \text{ balls different colours}) = 1 - \mathrm{P}(\text{same colour}) = 1 - \frac{9}{20} \times \frac{8}{19} - \frac{6}{20} \times \frac{5}{19} - \frac{5}{20} \times \frac{4}{19} = \frac{129}{190}$

b) $\mathrm{P}(\text{all different colour}) = \frac{9}{20} \times \frac{6}{19} \times \frac{5}{18} \times 6 = \frac{9}{38}$

Elementary Math Topical (Probability)

Question 9:

A biased die is used in a board game. The table below shows the probabilities of obtaining the scores when the die is thrown once.

Score	1	2	3	4	5	6
Probability	0.05	0.1	0.2	$2p$	0.25	0.3

a) Calculate the value of p.

In the game, a player throws the die and moves his counter forward equal to the score shown on the die. If the counter lands on " Landmine", he loses the game immediately.

33	34	35	36	37	38	39	40
Jim	Collect Power-up	Landmine 			Collect Power-up		Winner 

Jim's counter is on number 33. Find the probability that

b) he collects both power-up at the next two consecutive throws,

c) he avoids the land mine at the next two throws.

a)

$$0.05 + 0.1 + 0.2 + 2p + 0.25 + 0.3 = 1$$

$$2p = 0.1$$

$$p = 0.05$$

b) $\text{P(collect both power up)} = \text{P(roll 1 then 4)} = 0.05 \times 2(0.05) = 0.15$

c) $\text{P(avoid land mine)} = 1 - \text{P(hit land mine)} = 1 - \text{P(roll 1 then 1)} - \text{P(roll 2)}$

$$= 1 - 0.05 \times 0.05 - 0.1$$

$$= 0.8$$

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Question 10:

Sam has one 10¢ coin, one 20¢ coin, one 50¢ coin and one $1 coin in his right pocket.

He has one 20¢ coin, one 50¢ coin and one $1 coin in his left pocket.

A coin is taken out at random from each pocket.

a) Constructs a possibility diagram showing all the possible outcomes,

Find the probability that

b) the total value of the two coins is $1.20,

c) the total value of the two coins is more than $1.20,

d) the two coins do not have the same value.

a)

	10	20	50	$1
20	(10, 20)	(20,20)	(50,20)	($1,20)
50	(10,50)	(20,50)	(50,50)	($1,50)
$1	(10, $1)	(20, $1)	(50, $1)	($1, $1)

b) $P(\text{total value is } \$1.20) = \frac{2}{12} = \frac{1}{6}$

c) $P(\text{total calue is more than } \$1.20) = \frac{3}{12} = \frac{1}{4}$

d) $P(\text{two different coin}) = \frac{9}{12} = \frac{3}{4}$

Elementary Math Topical (Probability)

Question 11:

A bag contains 3 red balls, 2 white balls and 1 blue ball.
Two balls are taken from the bag at random, without replacement.
Find the probability that the two balls are of

a) the same colour,
b) different colour.

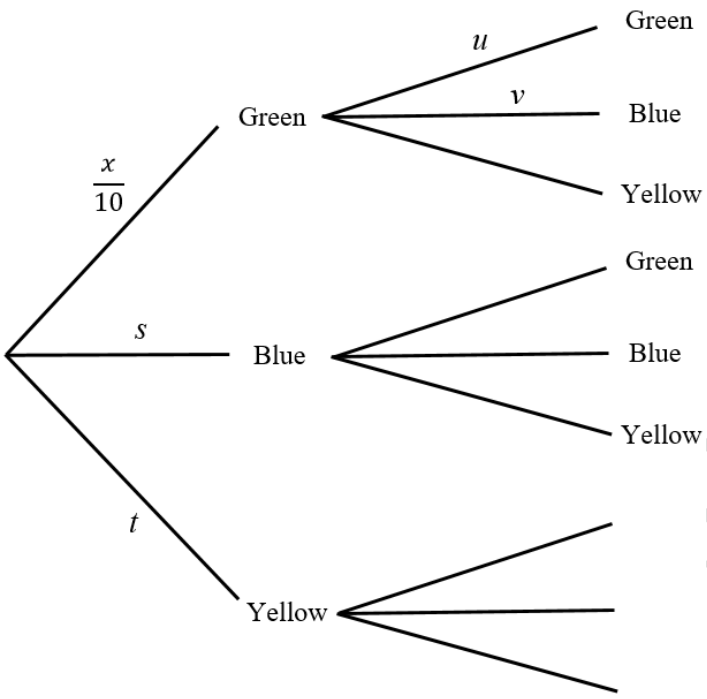
a) $\mathrm{P(same\ colour)} = \frac{3}{6} \times \frac{2}{5} + \frac{2}{6} \times \frac{1}{5} = \frac{4}{15}$

b) $\mathrm{P(different\ colour)} = 1 - \mathrm{P(same\ colour)} = 1 - \frac{4}{15} = \frac{11}{15}$

Elementary Math Topical (Probability)

Question 12:

A bag contains 10 coloured balls. Of these balls, *x* are green, *x*+1 are blue and the rest are yellow. John draws 2 balls at random, one after another, from the bag with no replacement. The partial tree diagram for the balls drawn is as shown below



a) Leaving your answer in terms of *x* where necessary, Write down the values of *s*, *t*, *u* and *v*,

b) If the probability of getting 2 green balls for John is $\frac{1}{15}$, find the value of *x*.

a) $s = \frac{x+1}{10}$, $t = \frac{10-x-x-1}{10} = \frac{9-2x}{10}$, $u = \frac{x-1}{9}$, $v = \frac{x+1}{9}$

b)

$$\frac{x}{10} \times \frac{x-1}{9} = \frac{1}{15}$$

$$15(x^2 - x) = 90$$

$$15x^2 - 15x - 90 = 0$$

$$x^2 - x - 6 = 0$$

$$(x-3)(x+2) = 0$$

$$x = 3 \text{ or } x = -2 \text{ (NA)}$$

Elementary Math Topical (Probability)

Question 13:

a) A bag contains 3 blue balls, 10 yellow balls and x red balls. A ball is chosen at random. The probability of getting a blue or red ball is $\frac{1}{3}$. Find the probability of getting a red ball.

Container A contains 5 mints, 3 caramels and 4 nougats. Container B contains 4 mints, 5 caramels and 3 nougats. Two sweets are chosen at random, one from container A and one from container B. Find the probability that the sweets chosen are

b) both nougats,

c) both different.

a)

$$\frac{3+x}{3+10+x}=\frac{1}{3}$$

$$9+3x=13+x$$

$$2x=4$$

$$x=2$$

$$\text{P(a red ball)}=\frac{2}{15}$$

b) $\text{P(both nougats)}=\frac{4}{12}\times\frac{3}{12}=\frac{1}{12}$

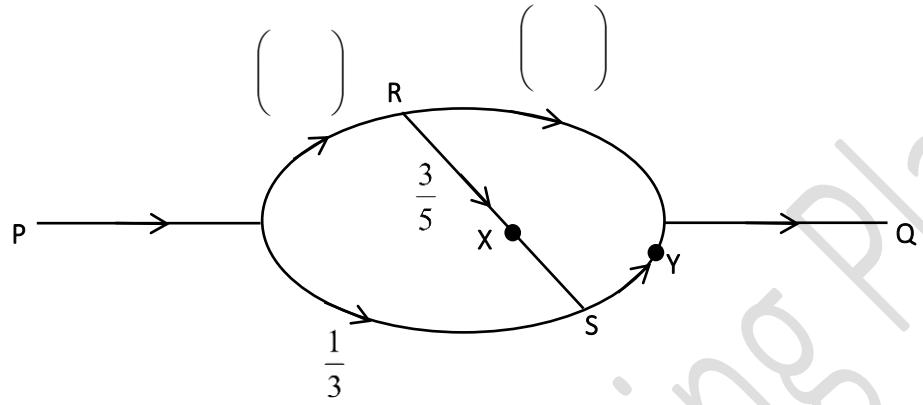
c) $\text{P(both different)}=1-\text{P(both side)}=1-\frac{5}{12}\times\frac{4}{12}-\frac{3}{12}\times\frac{5}{12}-\frac{1}{12}=\frac{3}{4}$

Elementary Math Topical (Probability)

Question 14:

The diagram shows a one-way road system between two junctions P and Q. The probability that a car travels along PS is $\frac{1}{3}$. At junction R, the probability that the car travels along RS is $\frac{3}{5}$.

a) Complete the diagram below.



Find the probability that the car travelling from P to Q

b) will pass point X.

c) will pass point Y.

a) $\frac{2}{3}$, $\frac{2}{5}$

b) $\mathrm{P}(\text{pass through } X) = \frac{2}{3} \times \frac{3}{5} = \frac{2}{5}$

c) $\mathrm{P}(\text{pass through } Y) = \frac{2}{3} \times \frac{3}{5} + \frac{1}{3} = \frac{11}{15}$

Elementary Math Topical (Probability)

Question 15:

300 chips consisting of *x* red chips and *y* blue chips are put inside a bag. A chip is randomly selected from the bag. If the probability of selecting a red chip is $\frac{6}{25}$ and the probability of selecting a blue chip is $\frac{3}{10}$, find the values of *x* and *y*.

$$\frac{x}{300} = \frac{6}{25}$$

$$x = 72$$

$$\frac{y}{300} = \frac{3}{10}$$

$$y = 90$$

Question 16:

Two unbiased dice are thrown and the scores are added together.

(a) Find the probability that both the scores are different.

(b) Find the probability that the score is 12.

(c) Find the probability that the score is 1.

a) $\mathrm{P(score\ different)} = 1 - \mathrm{P(score\ same)} = 1 - \left(\frac{1}{6} \times \frac{1}{6} \times 6\right) = \frac{5}{6}$

b) $\mathrm{P(score\ is\ 12)} = \mathrm{P}(6,6) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

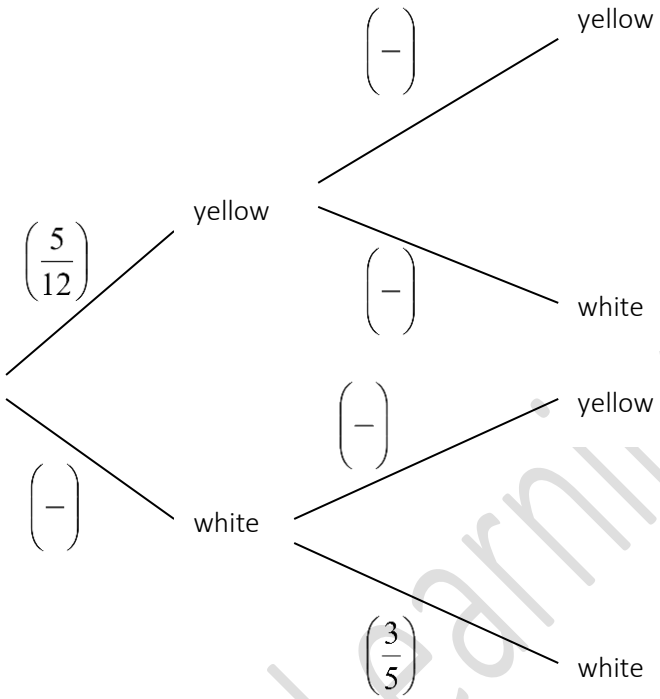
c) $\mathrm{P(score\ is\ 1)} = 0$

Elementary Math Topical (Probability)

Question 17:

Box *A* contains 5 yellow and 7 white marbles. Box *B* contains 4 yellow and 6 white marbles. A marble is drawn at random from Box *A* followed by another marble from Box *B*.

a) **Copy** and complete the probability tree diagram.



b) Hence, find the probability of drawing two marbles of different colours.

a) $\frac{7}{12}, \frac{2}{5}, \frac{3}{5}, \frac{2}{5}$

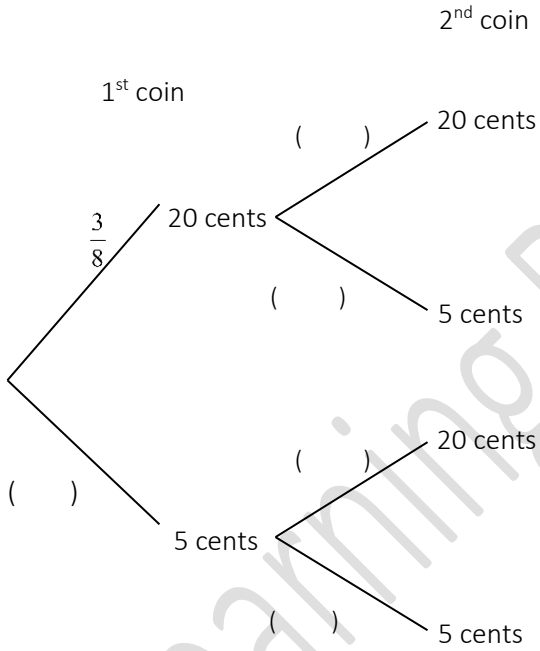
b) $\text{P(different colour)} = 1 - \text{P(same colour)} = 1 - \frac{5}{12} \times \frac{2}{5} - \frac{7}{12} \times \frac{3}{5} = \frac{29}{60}$

Elementary Math Topical (Probability)

Question 18:

Monnie has three 20 cents coins and five 5-cents coins in her purse. She removes two coins at random from the purse, one after another. The coins are not replaced.

a) In the answer space, complete the tree diagram.



b) Find the probability that the total value of the two coins removed is 25 cents.

Monnie removes a third coin from the purse.

c) Find the probability that the total value of three coins removed is at least 30 cents.

a) $\frac{5}{8}, \frac{2}{7}, \frac{5}{7}, \frac{3}{7}, \frac{4}{7}$

b) $\mathrm{P(total\ value\ is\ 25\ cents)} = \frac{3}{8} \times \frac{5}{7} + \frac{5}{8} \times \frac{3}{7} = \frac{15}{28}$

c) $\mathrm{P(at\ least\ 30\ cents)} = 1 - \mathrm{P(less\ than\ 30\ cents)} = \frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} = \frac{5}{28}$

Elementary Math Topical (Probability)

Question 19:

Century Up is a game for two or more players. It involves throwing a fair 8-sided dice numbered 1 to 8 on each face.

The rule of the games are as followed:

1) When is a player's turn, he may throw as many times as he likes, or until a '1' is thrown.

2) If a '1' is thrown, the player's score becomes zero.

3) If the player decides to stop, his score is the sum of all throws.

4) The first player to reach 100 (or beyond) is the winner.

Amos' current score is 94 and it is his turn

a) What is the probability that he wins with just one throw?

b) What is the probability that he wins in exactly two throws?

c) Amos' decide to keep throwing until he wins or get a '1'. Find the probability that he will not win the game during his turn?

a) $\mathrm{P}(\text{win with one throw}) = \frac{3}{8}$

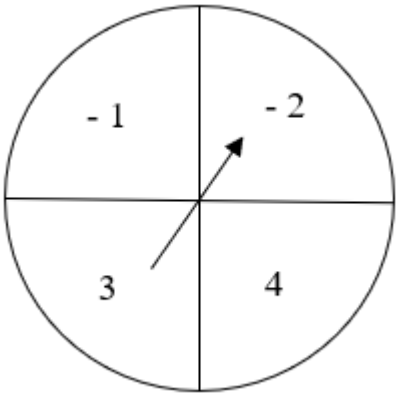
b) $\mathrm{P}(\text{win in exactly 2 throws}) = 1 - \mathrm{P}(\text{did not win in 2 throws}) = 1 - \frac{1}{8} - \frac{7}{64} = \frac{49}{64}$

c) $\mathrm{P}(\text{will not win}) = \frac{1}{8} + \frac{4}{64} + \frac{3}{512} = \frac{99}{512}$

Elementary Math Topical (Probability)

Question 20:

A spinner shown below is spun twice and the product of the two numbers noted.



a) Complete the possibility diagram below.

×	- 1	- 2	3	4
- 1	1	2	-3	-4
- 2	2	4	-6	-8
3	-3	-6	9	12
4	-4	-8	12	16

Find the probability that

a) the product is less than 12,

b) at least one of the numbers on the spinner is odd.

a) $\mathrm{P}(\text{product less than } 12) = \frac{13}{16}$

b) $\mathrm{P}(\text{at least one is odd}) = 1 - \mathrm{P}(\text{both even}) = 1 - \frac{2}{4} \times \frac{2}{4} = \frac{3}{4}$