Probability Worksheet Yr 11 Maths B WS2

1 A die is rolled. What is the probability that the number is an odd number or a 4?

You MUST state your rule EVERY time you use it:

$$P = \frac{WO}{PO}$$

$$= \frac{4}{6}$$

$$= \frac{2}{3}$$

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2 A die is rolled. What is the probability that the number is an odd number or a 4?

You MUST state your rule EVERY time you use it:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(odd \cup 4) = P(odd) + P(4) - P(odd \cap 4)$$

$$= \frac{3}{6} + \frac{1}{6} - 0$$

$$= \frac{4}{6}$$

$$= \frac{2}{3}$$

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3 A set of cards is numbered {1, 2, 3 … 16}.
A card is selected at random. Find:

(a) P(multiple of 5 or a multiple of 6)

(b) P(a number less than 7 or greater than 8).

(a) $\text{P(multiple of } 5 \cup 6) = \frac{3+2}{16}$

$$= \frac{5}{16}$$

(b) $\text{P}(<7 \cup >8) = \frac{6+8}{16}$

$$= \frac{14}{16}$$

$$= \frac{7}{8}$$

4 A card is selected at random from a pack of 52 playing cards. Find:

(a) $\mathrm{P}(\text{a heart or a black card})$

(a) $\mathrm{P}(\text{heart} \cup \text{black}) = \dfrac{13+26}{52}$

$= \dfrac{39}{52}$

$= \dfrac{3}{4}$

(b) $\mathrm{P}(\text{an ace or a picture card (J,Q,K)})$.

(b) $\mathrm{P}(\text{ace} \cup \text{picture}) = \dfrac{4+4\times 3}{52}$

$= \dfrac{16}{52}$

$= \dfrac{4}{13}$

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5 A card is selected at random from a pack of 52 playing cards. Find:

(a) $\mathrm{P}(\text{a diamond or a red card})$

(a) $\mathrm{P}(\text{diamond} \cup \text{red card})$

$= \mathrm{P}(\text{diamond}) + \mathrm{P}(\text{red card})$

$- \mathrm{P}(\text{red card} \cap \text{diamond})$

$= \dfrac{13}{52} + \dfrac{26}{52} - \dfrac{13}{52}$

$= \dfrac{26}{52}$

$= \dfrac{1}{2}$

(b) $\mathrm{P}(\text{a queen or a black card})$.

(b) $\mathrm{P}(\text{queen} \cup \text{black card})$

$= \mathrm{P}(\text{queen}) + \mathrm{P}(\text{black card})$

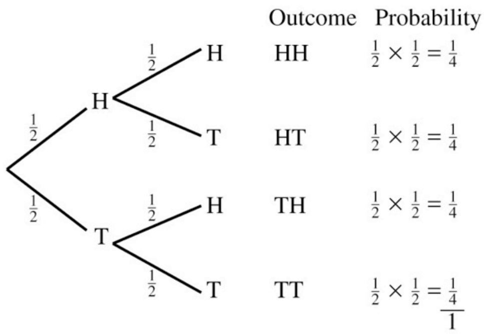
$- \mathrm{P}(\text{queen} \cap \text{black})$

$= \dfrac{4}{52} + \dfrac{26}{52} - \dfrac{2}{52}$

$= \dfrac{28}{52}$

$= \dfrac{7}{13}$

6 Two fair coins are tossed. Draw a tree diagram and find the probability of tossing:



(a) 2 Heads

(a) $P(\text{2 Heads}) = \dfrac{1}{4}$

(b) a Head and a Tail.

(b) $P(\text{Head} \cap \text{Tail}) = P(HT) + P(TH)$

$= \dfrac{1}{4} + \dfrac{1}{4}$

$= \dfrac{1}{2}$

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7 A coin is tossed and a die is rolled.

(a) Draw a two-way table to show the sample space.

(a)

Coin outcomes \ Die outcomes	1	2	3	4	5	6
H	(H, 1)	(H, 2)	(H, 3)	(H, 4)	(H, 5)	(H, 6)
T	(T, 1)	(T, 2)	(T, 3)	(T, 4)	(T, 5)	(T, 6)

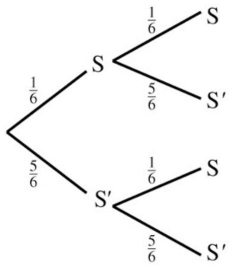
(b) Find the probability of getting a Tail with a number greater than 4.

(b) $P(\text{Tail} \cap > 4) = P(5, T) + P(6, T)$

$= \dfrac{2}{12}$

$= \dfrac{1}{6}$

8 Two dice are rolled. Use a tree diagram to find the probability of rolling:



Outcome	Probability
SS	$\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$
SS′	$\frac{1}{6} \times \frac{5}{6} = \frac{5}{36}$
S′S	$\frac{5}{6} \times \frac{1}{6} = \frac{5}{36}$
S′S′	$\frac{5}{6} \times \frac{5}{6} = \frac{25}{36}$
	1

(a) two sixes

(a) $$\text{P(two sixes)} = \text{P(SS)} = \frac{1}{36}$$

(b) one six

(b) $$\begin{aligned}\text{P(one six)} &= \text{P(SS}'\text{)} + \text{P(S}'\text{S)} \\ &= \frac{5}{36} + \frac{5}{36} \\ &= \frac{5}{18}\end{aligned}$$

(c) at least one six.

(c) $$\begin{aligned}\text{P(at least one six)} &= 1 - \text{P(no sixes)} \\ &= 1 - \text{P(S}'\text{S}'\text{)} \\ &= 1 - \frac{25}{36} \\ &= \frac{11}{36}\end{aligned}$$

9 Two dice are rolled. Use a tree diagram to find the probability of rolling:

** Silly text book … you are doing 2 things, so you should do a 2-way table!

	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

There are 36 Possible Outcomes!

You MUST state your rule EVERY time you use it:

Roll two 6's

$$P = \frac{WO}{PO}$$

$$= \frac{1}{36}$$

Roll ONE 6

$$P = \frac{WO}{PO}$$

$$= \frac{10}{36}$$

$$= \frac{5}{18}$$

Roll at least one 6

$$P = \frac{WO}{PO}$$

$$= \frac{11}{36}$$

10 Two dice are rolled. ~~Use a tree diagram to find the probability of rolling:~~

Now use some rules to find the probability of:

Always state the rule before you use it!

$$P(A \cap B) = P(A) \times P(B|A)$$

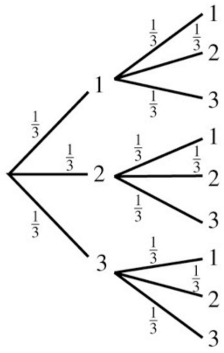
Roll two 6's

$$P(6 \cap 6) = P(6) \times P(6)$$

$$= \frac{1}{6} \times \frac{1}{6}$$

$$= \frac{1}{36}$$

11 A 2-digit number is to be formed using the digits 1, 2 and 3. If the same number can be used twice, find the probability that the number formed is:



Outcome	Probability
11	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
12	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
13	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
21	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
22	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
23	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
31	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
32	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
33	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$
	1

(a) 31

(a) $P(31) = \dfrac{1}{9}$

(b) greater than 30

(b) $P(>30) = P(31) + P(32) + P(33)$

$= \dfrac{1}{9} + \dfrac{1}{9} + \dfrac{1}{9}$

$= \dfrac{1}{3}$

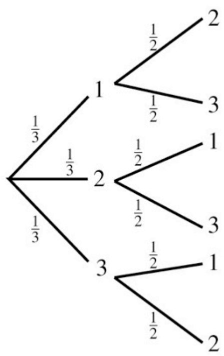
(c) odd.

(c) $P(\text{odd}) = P(11) + P(13) + P(21) + P(23) + P(31) + P(33)$

$= \dfrac{1}{9} + \dfrac{1}{9} + \dfrac{1}{9} + \dfrac{1}{9} + \dfrac{1}{9} + \dfrac{1}{9}$

$= \dfrac{2}{3}$

12 Repeat question **8** if the same digit cannot be used twice.



Outcome	Probability
12	$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$
13	$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$
21	$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$
23	$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$
31	$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$
32	$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$
	1

(a) $P(31) = \dfrac{1}{6}$

(b) $P(>30) = P(31) + P(32)$

$= \dfrac{1}{6} + \dfrac{1}{6}$

$= \dfrac{1}{3}$

(c) $P(\text{odd}) = P(11) + P(21) + P(23) + P(31)$

$= \dfrac{1}{6} + \dfrac{1}{6} + \dfrac{1}{6} + \dfrac{1}{6}$

$= \dfrac{2}{3}$

13 I can't fix all the text book questions … you may be able to tell the questions I have tried to fix up, but I can't get to all of them.

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14 A coin is tossed and a die is rolled. What is the probability of an even number on the die and Tails on the coin?

$$\begin{aligned} P(\text{even} \cap \text{Tails}) &= P(\text{even}) \times P(\text{Tails}) \\ &= \frac{3}{6} \times \frac{1}{2} \\ &= \frac{3}{12} \\ &= \frac{1}{4} \end{aligned}$$

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15 An 8-sided die and a 4-sided die are rolled.
Find:

(a) P(total of 7)

(b) P(total is a multiple of 3).

(a) P(total of 7)

$$\begin{aligned} &= P(6, 1) + P(5, 2) + P(4, 3) + P(3, 4) \\ &= \frac{1}{8} \times \frac{1}{4} + \frac{1}{8} \times \frac{1}{4} + \frac{1}{8} \times \frac{1}{4} + \frac{1}{8} \times \frac{1}{4} \\ &= \frac{1}{32} + \frac{1}{32} + \frac{1}{32} + \frac{1}{32} \\ &= \frac{4}{32} \\ &= \frac{1}{8} \end{aligned}$$

(b) P(total is a multiple of 3)

$$\begin{aligned} &= P(\text{total } 3) + P(\text{total } 6) + P(\text{total } 9) + P(\text{total } 12) \\ &= P(1, 2) + P(2, 1) + P(1, 5) + P(2, 4) + P(3, 3) + P(4, 2) + P(1, 8) + P(2, 7) + P(3, 6) + P(4, 5) + P(4, 8) \\ &= 11 \times \frac{1}{8} \times \frac{1}{4} \\ &= \frac{11}{32} \end{aligned}$$

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16 A netball player can shoot a goal 6 times out of every 10 throws. What is the probability of her shooting 2 goals from the next 2 throws?

$$\begin{aligned} P(2 \text{ goals}) &= \frac{6}{10} \times \frac{6}{10} \\ &= \frac{9}{25} \end{aligned}$$

17 A bag contains 30 apples of which 4 are rotten. Two apples are selected. What is the probability of selecting:

(a) 2 bad apples?

(a) $P(\text{2 bad apples}) = \frac{4}{30} \times \frac{3}{29} = \frac{2}{145}$

(b) 1 good and 1 bad apple?

(b) $P\left(\text{1 good apple and 1 bad apple}\right)$

$= P(\text{good and bad}) + P(\text{bad and good})$

$= \frac{26}{30} \times \frac{4}{29} + \frac{4}{30} \times \frac{26}{29}$

$= \frac{104}{870} + \frac{104}{870}$

$= \frac{104}{435}$

18 Annette is late for work once every 10 days. Glenda her assistant is late for work once every 5 days. What is the probability that:

(a) they are both on time?

(a) $P(\text{both on time}) = \frac{9}{10} \times \frac{4}{5} = \frac{18}{25}$

(b) only one of them is on time?

(b) $P(\text{one on time})$

$= P(\text{Annette on time and Glenda late})$

$\quad + P(\text{Annette late and Glenda on time})$

$= \frac{9}{10} \times \frac{1}{5} + \frac{1}{10} \times \frac{4}{5}$

$= \frac{13}{50}$

19 Campbell has a 0.6 chance of passing a spelling test and a 0.8 chance of passing a numeracy test.

(a) Find the probability that Campbell passes both his tests.

(a) $P(S \cap N) = 0.6 \times 0.8 = 0.48$

(b) Find the probability that Campbell passes only one test.

(b) $P(\text{passes only one test})$

$= P(S, \text{not } N) + P(\text{not } S, N)$

$= (0.6 \times 0.2) + (0.4 \times 0.8)$

$= 0.12 + 0.32$

$= 0.44$

20	In her drawer, Mai has 6 blue socks and 4 red socks. Mai randomly selects 2 socks. What is the probability of Mai selecting 2 socks with the same colour?	P(same colour) = P(2 blue socks) + P(2 red socks) $= \frac{6}{10} \times \frac{5}{9} + \frac{4}{10} \times \frac{3}{9}$ $= \frac{30}{90} + \frac{12}{90}$ $= \frac{7}{15}$
21	To enter a gambling house, you need to correctly guess the outcome of a die roll more often than not. You have three rolls to guess. What is the probability you can enter the gambling house.	To enter need to get at least 2 guesses correct. That is, 2 correct guesses, or three correct guesses. To get 2 correct guesses, you could get the first two Correct and the third Incorrect, or you could get the first Incorrect and the next 2 Correct etc etc and you end up with: $P(Entry) = P(C \cap C \cap I) + P(C \cap I \cap C) + P(I \cap C \cap C) + P(C \cap C \cap C)$ becomes, $P = \frac{1}{6} \times \frac{1}{6} \times \frac{5}{6} + \frac{1}{6} \times \frac{5}{6} \times \frac{1}{6} + \frac{5}{6} \times \frac{1}{6} \times \frac{1}{6} + \frac{1}{6} \times \frac{1}{6} \times \frac{1}{6}$ $= \frac{2}{27}$ This is a trick question … because you have learnt Probability with Mr Finney and know it so well, gambling does not interest you … ☺

22 Two cards are randomly selected from a pack of cards. What is the probability both cards are:

(a) black?

(a) $P(\text{both black}) = \frac{26}{52} \times \frac{25}{51}$
$= \frac{25}{102}$

(b) clubs?

(b) $P(\text{both clubs}) = \frac{13}{52} \times \frac{12}{51}$
$= \frac{1}{17}$

(c) aces?

(c) $P(\text{both aces}) = \frac{4}{52} \times \frac{3}{51}$
$= \frac{1}{221}$

(d) black aces?

(d) $P(\text{both black aces}) = \frac{2}{52} \times \frac{1}{51}$
$= \frac{1}{1326}$

(e) A black card followed by a red card

(e) $P(\text{black and Red}) = \frac{26}{52} \times \frac{26}{51}$
$= \frac{13}{51}$

(f) A black and red card

(f) P(black and red)
$= P(B \cap R) \text{ or } P(R \cap B)$
$= \frac{26}{52} \times \frac{26}{51} + \frac{26}{52} \times \frac{26}{51}$
$= \frac{26}{51}$

23 In a class of 28 students, 2 students are selected at random. Mark and Elise are two students in this class. What is the probability that:

(a) one of them is selected?

(a) P(one is selected)
= P(Mark selected and Elise not)
+ P(Elise not and Mark selected)
+ P(Elise selected and Mark not)
+ P(Mark not and Elise selected)
$= \frac{1}{28} \times \frac{26}{27} + \frac{27}{28} \times \frac{1}{27} + \frac{1}{28} \times \frac{26}{27} + \frac{27}{28} \times \frac{1}{27}$
$= \frac{53}{378}$

(b) both are selected?

(b) $P(\text{both are selected}) = \frac{2}{28} \times \frac{1}{27}$
$= \frac{1}{378}$

24	In a year 11 cohort of 60 students, 35 love Maths and 40 love English. What is the probability the teacher randomly selects a maths lover, given they are an English lover?	Clearly some students like both Maths and English … 15 students like both. $$P(like\ Maths) = \frac{35}{60}$$ $$P(like\ English) = \frac{40}{60}$$ $$P(like\ Maths \cap English) = \frac{15}{60}$$ $$P(A \cap B) = P(A) \times P(B\|A)$$ $$P(E \cap M) = P(E) \times P(M\ \|E)$$ $$\frac{15}{60} = \frac{40}{60} \times P$$ $$P = \frac{15}{40} = \frac{3}{8}$$ You could also do a Venn Diagram for this question … ☺
25	Use the Binomial theorem to expand $$(x+2)^4$$	You need to know Pascals Triangle: 1 1 1 2 1 1 3 3 1 1 4 6 4 1 You need to know the pattern of the powers (First term). $$x^4 \quad x^3 \quad x^2 \quad x^1 \quad x^0$$ You need to know the pattern of the powers (Second term). $$2^0 \quad 2^1 \quad 2^2 \quad 2^3 \quad 2^4$$ And to put them together $$1\,x^4\,2^0 + 4\,x^3\,2^1 + 6\,x^2\,2^2 + 4\,x^1\,2^3 + x^0\,2^4$$ And simplify; $$x^4 + 8\,x^3 + 24\,x^2 + 32\,x + 16$$

26	Its not much different with negatives. Use the Binomial theorem to expand $(x-2)^4$	You need to know Pascals Triangle: 1 1 1 2 1 1 3 3 1 1 4 6 4 1 You need to know the pattern of the powers (First term). $x^4 \quad x^3 \quad x^2 \quad x^1 \quad x^0$ You need to know the pattern of the powers (Second term). $(-2)^0 \quad (-2)^1 \quad (-2)^2 \quad (-2)^3 \quad (-2)^4$ And to put them together $1\,x^4\,1 + \;4\,x^3\,.-2 + \;6\,x^2\,4 + \;4\,x^1.-8 + \;x^0\,16$ And simplify; $x^4 - 8\,x^3 + 24\,x^2 - 32\,x \;+\; 16$
27	Its not much different with negatives and a coefficient of x. Use the Binomial theorem to expand $(2x-1)^4$	You need to know Pascals Triangle: 1 4 6 4 1 You need to know the pattern of the powers (First term). $(2x)^4 \quad (2x)^3 \quad (2x)^2 \quad (2x)^1 \quad (2x)^0$ You need to know the pattern of the powers (Second term). $(-1)^0 \quad (-1)^1 \quad (-1)^2 \quad (-1)^3 \quad (-1)^4$ And put them together simplified; $16x^4 - 32\,x^3 + 24\,x^2 - 8\,x \;+ 1$

28	Use the Binomial theorem to determine the ‘ x^2 ‘ term in the expansion of $$(x+2)^5$$	Use; $$_nC_r\, x^{n-r}y^r$$ Term becomes; $$_5C_3 \times x^{5-3} \times (2)^3$$ $$= \frac{5!}{(5-3)! \times 3!} \times x^2 \times 8$$ $$= \frac{5 \times 4 \times 3!}{2 \times 1 \times 3!} \times x^2 \times 8$$ $$= 10 \times x^2 \times 8$$ $$= 80x^2$$
29	Use the Binomial theorem to determine the ‘x’ term in the expansion of $$(2x-1)^{10}$$	Use; $$_nC_r\, x^{n-r}y^r$$ Term becomes; $$_{10}C_9 \times (2x)^{10-9} \times (-1)^9$$ $$= \frac{10!}{(10-9)! \times 9!} \times 2x \times -1$$ $$= \frac{10 \times 9!}{1 \times 9!} \times -2x$$ $$= 10 \times -2x$$ $$= -20x$$