

Two-way tables

Starter

1. **(Review of last lesson)** Write down the three equations of motion needed at GCSE level, stating which letter is missing from each equation.

Working:

$v = u + at$	No s in the equation
$s = ut + \frac{1}{2}at^2$	No v in the equation
$v^2 = u^2 + 2as$	No t in the equation

2. **(Review of last lesson)** A boy drops a rock over the edge of cliff and it takes 5 seconds to reach the sea. Assume the acceleration due to gravity is 9.8 m/s^2 .

- (a) How high is the cliff?
 (b) Find the velocity of the rock as it hits the sea (assume it does not reach its terminal velocity).
 (c) The boy throws a second rock down and it takes 4 seconds to hit the sea. What speed did he throw the rock down with?

Working:

(a) "Drops" $\Rightarrow u = 0$ Also: $a = 9.8, t = 5, s = ?$
 No $v \Rightarrow s = ut + \frac{1}{2}at^2: \quad s = 0 + \frac{1}{2} \times 9.8 \times 5^2$
 $s = 122.5$.

The cliff is 122.5 m high

- (b) **Try to avoid using the value calculated in (a) in case your answer is wrong.**

$u = 0, a = 9.8, t = 5, v = ?$
 No $s \Rightarrow v = u + at: \quad v = 0 + 9.8 \times 5$
 $v = 49$

The velocity of the rock as it hits the sea is 49 m/s.

- (c) $a = 9.8, t = 4, u = ?$
We don't know v so we have to use the s -value from (a).

$a = 9.8, t = 4, s = 122.5, u = ?$
 No $v \Rightarrow s = ut + \frac{1}{2}at^2: \quad 122.5 = 4u + \frac{1}{2} \times 9.8 \times 4^2$
 $122.5 = 4u + 78.4$
 $4u = 44.1$
 $u = 11.025$

The boy threw the stone with initial speed 11.025 m/s.

- E.g. 1** (a) Copy and complete the two-way table about whether people prefer to watch films in the cinema or on television at home.

	Cinema	Television	Total
Over 30s		6	
Under 30s	14		23
Total	33		

- (b) State how many:
 (i) Over 30s were included in the survey
 (ii) Under 30s preferred watching films on television at home.
 (c) Compare film watching preferences for over and under 30s. Use percentages to support your statement.

Working: (a)

	Cinema	Television	Total
Over 30s	$33 - 14 = 19$	6	$19 + 6 = 25$
Under 30s	14	$23 - 14 = 9$	23
Total	33	$6 + 9 = 15$	$25 + 23 = 48$

- (b) (i) 25
 (ii) 9

- (c) Preference for cinema: Over 30s = $\frac{19}{25} \times 100\% = 76\%$
 Under 30s = $\frac{14}{23} \times 100\% \approx 60.9\%$

Both age groups prefer to watch films in the cinema but this is more apparent for the over 30s (76%) than in the under 30s age group ($\approx 61\%$)

E.g. 2 Complete the following two-way table about the type of music adults and children prefer listening to out of pop, classical and rock. Then answer the questions that follow.

	Pop	Classical	Rock	Total
Adults	6	18		37
Children			12	
Total	33			80

- How many people like rock music in all?
- What is the probability of choosing a person who likes classical music?
- What is the probability of choosing an adult who likes rock music?
- What is the probability that choosing a person who likes rock music is a child?

Working

	Pop	Classical	Rock	Total
Adults	6	18	<i>a</i>	37
Children	<i>b</i>	<i>c</i>	12	<i>d</i>
Total	33	<i>e</i>	<i>f</i>	80

We can fill in the numbers *a*, *b* and *d* straight away.

$$a = 37 - 6 - 18 = 13 \quad b = 33 - 6 = 27 \quad d = 80 - 37 = 43$$

With these numbers filled in, we can now complete the table.

$$c = 43 - 12 - 27 = 4 \quad f = 13 + 12 = 25 \quad e = 18 + 4 = 22$$

	Pop	Classical	Rock	Total
Adults	6	18	13	37
Children	27	4	12	43
Total	33	22	25	80

Now check the totals to make sure they are correct.

- 25 people like rock music in all
- What is the probability of choosing a person who likes classical music?
 "Person" is the first criteria so the probability is out of 80.
 22 people like classical music so $\frac{22}{80} = \frac{11}{40}$
- What is the probability of choosing an adult who likes rock music?
 "Adult" is the first criteria so the probability is out of 37.
 Out of all adults, 13 like rock music so the probability is $\frac{13}{37}$.

- (d) What is the probability that choosing a person who likes rock music is a child?
“Rock music” is the first criteria so the probability is out of 25.
Out of these 25 people, 12 are children.
So the answer is $\frac{12}{25}$.

E.g. 3 The students in a two year groups, Y8 and Y9, gave their sporting preference:

Y8, Football	Y9, Hockey	Y9, Tennis	Y8, Football
Y8, Hockey	Y8, Football	Y8, Tennis	Y9, Hockey
Y9, Tennis	Y9, Football	Y9, Hockey	Y8, Football
Y9, Football	Y9, Tennis	Y9, Football	Y9, Hockey

- (a) Record the results in a two-way table.
(b) What percentage of the students prefer tennis?
(c) What percentage of Y9 students prefer football?

Working: (a)

	Football	Hockey	Tennis	Total
Y8	4	1	1	6
Y9	3	4	3	10
Total	7	5	4	16

- (b) “Students” so out of 16.
Percentage prefer tennis = $\frac{4}{16} \times 100\% = 25\%$
- (c) “Y9 students” so out of 10.
Percentage of Y9 students prefer football = $\frac{3}{10} \times 100\% = 30\%$

Video: [Two-way tables](#)

[Solutions to Starter and E.g.s](#)

Exercise

9-1 class textbook: p351 M11.1 Qu 1-5
A*-G class textbook: p315 M11.1 Qu 1-5
9-1 homework book: p120 M11.1 Qu 1-4
A*-G homework book: p88 M11.1 Qu 1-4