

## Level 7 – Number and Algebra

### Overview

<b>Activity name</b>	Over- and under-estimates
<b>Learning intention</b>	To make over- and under-estimates and calculate answers to check reasonableness of results.
<b>Duration</b>	40 minutes

### Links to Victorian Curriculum

These work samples are linked to [Level 7](#) of the Mathematics curriculum.

### Extract from Mathematics Level 7 achievement standard

They solve problems involving all four operations with fractions, decimals, percentages.

They make simple estimates to judge the reasonableness of results.

### Relevant content descriptions

- Multiply and divide fractions and decimals using efficient written strategies and digital technologies (VCMNA244)
- Round decimals to a specified number of decimal places (VCMNA246)
- Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies. (VCMNA248)

### Links to NAPLAN

#### Minimum standards – numeracy

##### [Year 7: Number](#)

##### Applying number

Students form estimates and make approximations. They interpret and solve practical problems using appropriate operations. For example, students can generally: ...

- solve simple rate problems involving time and distance
- select an appropriate approximation to a calculation involving money
- interpret and solve practical problems involving division, with access to a calculator.

##### Calculating

Students use mental and written methods with addition, subtraction, multiplication and division. They use a calculator to assist with more complex calculations.

For example, students can generally:

- solve simple problems in familiar contexts involving addition or subtraction of integers
- use knowledge of place value to multiply and divide decimals by 10 and 100
- perform calculations involving key percentages or addition and subtraction of decimal numbers with the same number of decimal places.

# Mathematics – Annotated student work samples

## Student work samples – Over- and under-estimates

These work samples were created by students working at Level 7. Evidence of student achievement has been annotated.

### Victorian Curriculum link

Multiply and divide fractions and decimals using efficient written strategies and digital technologies (VCMNA244)

Round decimals to a specified number of decimal places (VCMNA246)

### Part 1

- a. Form an under- estimate for the total price of the items shown below. Show how you obtained this under-estimate.

Item A	\$	1.17
Item B	\$	8.93
Item C	\$	5.36
Item D	\$	2.19
Item E	\$	12.68
Item F	\$	0.95
Item G	\$	10.11

$\$1.17 \rightarrow \$1.0$   
 $\$8.93 \rightarrow +\$8.50$   
 $\$5.36 \rightarrow +\$5.00$   
 $\$2.19 \rightarrow +\$2.00$   
 $\$12.68 \rightarrow +\$12.50$   
 $\$0.95 \rightarrow +\$0.50$   
 $\underline{29.50}$

$\$10.11 \rightarrow \$10.00 = 39.5$   
 $\begin{array}{r} 29.50 \\ + 10.00 \\ \hline 39.5 \end{array}$   
 $\$39.5 - 35.0$   
 $= \$39$

Rounds given numbers down to the nearest 50 cents

Adds the remaining \$10 to form an under-estimate of \$39

Calculates total using vertical algorithm

- a. Form an under- estimate for the total price of the items shown below. Show how you obtained this under-estimate.

Item A	\$	1.17
Item B	\$	8.93
Item C	\$	5.36
Item D	\$	2.19
Item E	\$	12.68
Item F	\$	0.95
Item G	\$	10.11

Under-Estimate: \$37

For cents, there's about \$4.  
For dollars, there's about \$35

$\begin{array}{r} 4 \\ + 33 \\ \hline 37 \end{array}$

Adds the estimate vertically

Rounds the total whole dollars down by \$2 to form under-estimate

Estimates the number of cents and dollars

# Mathematics – Annotated student work samples

a. Form an under-estimate for the total price of the items shown below. Show how you obtained this under-estimate.

Item A	\$ 1.17
Item B	\$ 8.93
Item C	\$ 5.36
Item D	\$ 2.19
Item E	\$ 12.68
Item F	\$ 0.95
Item G	\$ 10.11

I am going to make them all \$5 so  
it is easier to count there is 7  
items and  $5 \times 7 = 35$  that is my underestimate

Rounds all items to \$5 and multiplies by the amount of items to calculate an under-estimate of \$35

a. Form an under-estimate for the total price of the items shown below. Show how you obtained this under-estimate.

Item A	\$ 1.17 - rounded to \$1.00
Item B	\$ 8.93 - rounded to \$9.00
Item C	\$ 5.36 - rounded to \$5.00
Item D	\$ 2.19 - rounded to \$2.00
Item E	\$ 12.68 - rounded to \$13.00
Item F	\$ 0.95 - rounded to \$1.00
Item G	\$ 10.11 - rounded to \$10.00

$\Rightarrow \$41$

~~less~~  
A = rounded to \$1  
B = rounded to \$8  
C = rounded to \$5  
D = rounded to \$2  
E = rounded to \$12  
F = rounded to \$1  
G = rounded to \$10  
 $= \$39.00$

Rounds all items to the nearest whole dollar to form an over-estimate

Then self corrects and rounds down to the nearest dollar, calculating an under-estimate of \$30

a. Form an under-estimate for the total price of the items shown below. Show how you obtained this under-estimate.

Item A	\$ 1.17
Item B	\$ 8.93
Item C	\$ 5.36
Item D	\$ 2.19
Item E	\$ 12.68
Item F	\$ 0.95
Item G	\$ 10.11

+ 1 → 9 → 38  
8 → 9  
5 → 7 → 29  
2 → 7  
12 → 12  
0 → 12  
10 → 22

Rounds all items down to the nearest whole dollar

38 = Estimate

Calculates an under-estimate of \$38 by adding two items at a time

# Mathematics – Annotated student work samples

- a. Form an under-estimate for the total price of the items shown below. Show how you obtained this under-estimate.

Item A	\$ 1.17
Item B	\$ 8.93
Item C	\$ 5.36
Item D	\$ 2.19
Item E	\$ 12.68
Item F	\$ 0.95
Item G	\$ 10.11

A: 1.10  
 B: 8.90  
 C: 5.30  
 D: 2.10  
 E: 12.60  
 F: 0.90  
 G: 10.10

$$\begin{aligned}
 1.10 + 8.90 &= 10 \\
 10 + 5.30 &= 15.30 \\
 15.30 + 2.10 &= 17.40 \\
 17.40 + 12.60 &= 30 \\
 30 + 0.90 &= 30.90 \\
 30.90 + 10.10 &= 31
 \end{aligned}$$

My underestimate is  
 \$31.00

Rounds down to the nearest 10 cents

Calculates under-estimate using a running total

- a. Form an under-estimate for the total price of the items shown below. Show how you obtained this under-estimate.

Item A	\$ 1.17
Item B	\$ 8.93
Item C	\$ 5.36
Item D	\$ 2.19
Item E	\$ 12.68
Item F	\$ 0.95
Item G	\$ 10.11

all rounded to the nearest 0.10c down.  
 all numbers added once rounded to reach total

Item	Price
A	\$1.10
B	\$8.90
C	\$5.30
D	\$2.10
E	\$12.60
F	\$0.90
G	\$10.10

Total = \$41.

Rounds all items to the nearest 10 cents

Sorts rounded-down items vertically to form an under-estimate

- a. Form an under-estimate for the total price of the items shown below. Show how you obtained this under-estimate.

Item A	\$ 1.17 ≈ \$1.00
Item B	\$ 8.93 ≈ \$8.50
Item C	\$ 5.36 ≈ \$5.00
Item D	\$ 2.19 ≈ \$2.00
Item E	\$ 12.68 ≈ \$12.50
Item F	\$ 0.95 ≈ \$0.50
Item G	\$ 10.11 ≈ \$10.00

$$\begin{aligned}
 &= 1 + 8.5 + 5 + 2 + 12.5 + 0.5 + 10 \\
 &= 39.5
 \end{aligned}$$

\$39.50

Rounds down to the nearest 50 cents and adds to form an under-estimate

Includes \$ symbol

Uses 'approximately' symbol (≈)

# Mathematics – Annotated student work samples

b. Form an over-estimate for the total price of the items. Show how you obtained this over -estimate.

$$\begin{array}{r} 2 \\ 9 \\ 6 \\ 3 \\ 13 \\ 1 \\ 11 \\ \hline \end{array}$$
 (Numbers rounded up) = \$45  
 Estimated Average Cents = 50c  
 7 items  $\times$  50c = \$3.50

$$\begin{array}{r} \$45.00 \\ + \$3.50 \\ \hline \$48.50 \end{array}$$

Rounds numbers up to the nearest dollar

Estimates the average as 50 cents

Adds the whole dollar total and the cents total to form an over-estimate

b. Form an over-estimate for the total price of the items. Show how you obtained this over -estimate.

$$\begin{array}{r} 2 \\ 9 \\ 6 \\ 3 \\ 13 \\ 1 \\ 11 \\ \hline 45 \end{array}$$
 = \$45

Rounds all items up to the nearest whole dollar

Calculates vertically with regrouping to form an over-estimate of \$45

# Mathematics – Annotated student work samples

b. Form an over-estimate for the total price of the items. Show how you obtained this over -estimate

A: 1.20 F: 1.00 1.20 + 9.00 = 10.20  
 B: 9.00 G: 10.20 10.20 + 5.40 = 15.60  
 C: 5.40 15.60 + 2.20 = 17.80  
 D: 2.20 17.80 + 12.70 = 30.50  
 E: 12.70 30.50 + 1.00 = 31.50  
 31.50 + 10.20 = 41.70

My overestimate is \$41.70

Rounds all items up to the nearest 10 cents

Calculates an over-estimate using a running total

b. Form an over-estimate for the total price of the items. Show how you obtained this over -estimate.

2 + 9 = 11 → 20  
 6 + 3 = 9 → 25  
 13 + 1 = 14 → 25  
 + 11 = 11 → 45

\$45

round all the numbers up

Rounds all items to the nearest whole dollar

Calculates over-estimate by adding in lots of two to calculate \$45 as the over-estimate

b. Form an over-estimate for the total price of the items. Show how you obtained this over -estimate

I am making all the prices \$10 so  $10 \times 7 =$   
 70 that is my over estimate

Rounds all items to \$10 then multiplies by the number of items to form an over-estimate

# Mathematics – Annotated student work samples

- c. Form an estimate for the total price of the items that lies between the estimates in a. and b. above. Show how you obtained this estimate.

~~\$49~~  
~~\$39~~  
 \$7.0  
 39, 40, 41, 42, 43  
 44, 45, 46, 47, 48  
 49  
 Median

\$44 = Median Estimate

Sorts the difference between the over- and under-estimates to find the median

Uses the median to form an estimate

- c. Form an estimate for the total price of the items that lies between the estimates in a. and b. above. Show how you obtained this estimate.

difference  

$$\begin{array}{r} \$48.50 \\ - \$41.50 \\ \hline \$7.00 \end{array}$$

$\div 2 = \$3.50$

$$\begin{array}{r} \$41.50 \\ + \$3.50 \\ \hline \$45.00 \end{array}$$

\$45.00

Calculates the difference between the over- and under-estimates using vertical algorithm and order of operations

Vertically adds the difference to the under-estimate to form an in-between estimate of \$45

- c. Form an estimate for the total price of the items that lies between the estimates in a. and b. above. Show how you obtained this estimate.

$$\begin{aligned} \$38 + \$45 &= \$83 \\ \$83 \div 2 &= \$41.5 \end{aligned}$$

I added my two estimates together and divided it by two to find the Average

The middle estimate is \$41.5

Estimates by averaging the under- and over-estimates

Correctly calculates the average between the estimates

# Mathematics – Annotated student work samples

d. Calculate the actual total price of the items

\$41.39

Answer includes \$

Uses a calculator to correctly add all items

I added all of the numbers together with a calculator

d. Calculate the actual total price of the items

$$\begin{array}{r}
 21.17 \\
 + 8.93 \\
 + 5.36 \\
 + 2.19 \\
 + 12.68 \\
 + 0.95 \\
 + 10.11 \\
 \hline
 41.39
 \end{array}$$

Correctly adds all items vertically with regrouping

d. Calculate the actual total price of the items

$$\begin{array}{r}
 1.17 \\
 + 8.93 \\
 \hline
 10.10 \\
 + 5.36 \\
 \hline
 15.46 \\
 + 2.19 \\
 \hline
 17.65 \\
 + 12.68 \\
 \hline
 30.33 \\
 + .95 \\
 \hline
 31.28
 \end{array}$$

$$\begin{array}{r}
 31.28 \\
 + 10.11 \\
 \hline
 41.39
 \end{array}$$

Uses a vertical algorithm with regrouping as a cumulative total to calculate the actual price of the items



# Mathematics – Annotated student work samples

d. Calculate the actual total price of the items

I will separate each digit, add those digits then add them all together

- \$1.17
- \$8.93
- \$5.26
- \$2.19
- \$12.68
- \$0.95
- \$0.11

Handwritten calculations showing the partitioning of each item's price into dollars, tenths, and hundredths, followed by the summation of these parts.

$\$0.07 \rightarrow \$0.1 \rightarrow \$0.25$   
 $\$0.03 \rightarrow \$0.15 \rightarrow \$0.39$   
 $\$0.06 \rightarrow \$0.15 \rightarrow \$0.39$   
 $\$0.09 \rightarrow \$0.13 \rightarrow \$0.14$   
 $\$0.08 \rightarrow \$0.13 \rightarrow \$0.14$   
 $\$0.05 \rightarrow \$0.13 \rightarrow \$0.14$   
 $\$0.01 \rightarrow \$0.13 \rightarrow \$0.14$

$\$0.1 \rightarrow \$1 \rightarrow \$1.4 \rightarrow \$3$   
 $\$0.9 \rightarrow \$1 \rightarrow \$1.4 \rightarrow \$3$   
 $\$0.3 \rightarrow \$0.4 \rightarrow \$1.4 \rightarrow \$3$   
 $\$0.1 \rightarrow \$1 \rightarrow \$1.4 \rightarrow \$3$   
 $\$0.6 \rightarrow \$1.5 \rightarrow \$1.6$   
 $\$0.9 \rightarrow \$1.5 \rightarrow \$1.6$   
 $\$0.1 \rightarrow \$1 \rightarrow \$1.4 \rightarrow \$3$

$\$0.25 + \$3 + \$38 = \$41.25$

Adds the total through partitioning

Adds the total of the three values to calculate the price of the items

Adds cents (hundredths) then cents (tenths) then whole dollars

# Mathematics – Annotated student work samples

The percentage error of an estimate is found by comparing the difference between the estimate and the actual value to the actual value and representing this as a percentage. The algorithm for this is given below:

- Step 1: calculate the difference: estimate – actual value
- Step 2: divide this difference by the actual value
- Step 3: multiply the answer to Step 2 by 100

Calculates the difference between the estimate and the actual value using vertical subtraction with regrouping

c. Calculate the percentage error using the estimate from c. and round this correct to one decimal place.

$$\begin{array}{r}
 3 \cancel{4} 1.39 \\
 - 38.00 \\
 \hline
 3.39
 \end{array}$$

$$\begin{array}{r}
 0.081903842 \\
 41.39 \overline{) 3.39} \\
 \underline{41.39} \\
 0
 \end{array}$$

$$\begin{array}{r}
 0.081903842 \\
 \times 100 \\
 \hline
 8.1903842
 \end{array}$$

$$\approx 8.1903842$$

Divides the difference by the actual value

Multiplies the result by 100 to find the percentage error, without rounding to one decimal place

The percentage error of an estimate is found by comparing the difference between the estimate and the actual value to the actual value and representing this as a percentage. The algorithm for this is given below:

- Step 1: calculate the difference: estimate – actual value
- Step 2: divide this difference by the actual value
- Step 3: multiply the answer to Step 2 by 100

Correctly uses a calculator to complete steps 1–3 to identify percentage error

e. Calculate the percentage error using the estimate from c. and round this correct to one decimal place.

Step 1: Actual Value – Estimate = Difference  
 $\$41.39 - \$41.25 = \$0.14$

Step 2: Difference  $\div$  Actual Value = Answer  
 $\$0.14 \div \$41.39 = 0.00338246$

Step 3: Answer (Step 2)  $\times$  100 (%) = Final Answer  
 $0.00338246 \times 100 = 0.338246$

Clearly labels the steps to complete the calculation

$0.338246\%$

Includes percentage symbol in calculation, without rounding to the nearest tenth

# Mathematics – Annotated student work samples

The percentage error of an estimate is found by comparing the difference between the estimate and the actual value to the actual value and representing this as a percentage. The algorithm for this is given below:

Step 1: calculate the difference:  $\text{estimate} - \text{actual value}$

Step 2: divide this difference by the actual value

Step 3: multiply the answer to Step 2 by 100

e. Calculate the percentage error using the estimate from c. and round this correct to one decimal place

$$[(\$39.50 - \$41.42) \div \$41.42] \times 100 = (-4.6)$$

Correctly includes steps in the line of working

Shows the order of steps within one line of working

Uses a calculator to determine percentage error as a negative number

Correctly rounds to the nearest tenth, without percentage symbol

The percentage error of an estimate is found by comparing the difference between the estimate and the actual value to the actual value and representing this as a percentage. The algorithm for this is given below:

Step 1: calculate the difference:  $\text{estimate} - \text{actual value}$

Step 2: divide this difference by the actual value

Step 3: multiply the answer to Step 2 by 100

e. Calculate the percentage error using the estimate from c. and round this correct to one decimal place.

$$\begin{aligned} \$41.5 - \$41.39 &= \$0.11 \\ \$0.11 \div \$41.39 &= 0.00265764677 \\ 0.00265765764677 \times 100 &= 0.26564677\% \end{aligned}$$

Calculates the difference as a positive value, accurately using the \$ symbol

Uses a calculator to divide the difference by the actual value

Rounds calculation to the nearest tenth and includes percentage symbol

with the answer above, I rounded it to 0.3%  
My total Percentage away from the correct total

Identifies calculation as a positive percentage error, explaining how 'far away' their estimation is from the actual value

# Mathematics – Annotated student work samples

## Part 2

Consider the docket for a weekend grocery shopping trip (shown below).

Carry out a. to e. from Part 1 for this list [see below]. Briefly discuss the accuracy of the estimate for Part 2.

- Form an under-estimate
- Form an over-estimate
- Form an estimate that lies between a. and b.
- Calculate the actual price
- Calculate the percentage error

Description	\$
*SCHNEPPES MIN WTR 1.1LITRE	9.00
5 @ \$1.50 EACH	
COLES DAIRY DIP 200GRAM	2.00
* MCCOONA INSTANT MED 100GRAM	7.00
MEDJOL DATES 454GRAM	10.00
D/L ELCO OLIVES KALA PERKG	3.68
* MAGGIE BEER DAIRY PA 100GRAM	5.00
AUSTRALIAN FETTA PERKG	2.85
MERSEY VALLEY VINTAG 180GRAM	6.00
* TAS HERITAGE DL BRIE 250GRAM	5.62
COLES DRIED APRICOTS 400GRAM	4.00
PERIND TOMATOES 200GRAM	4.50
TRUSS TOMATOES PERKG	4.91
0.621 kg NET @ \$7.90/kg	
RED PLUMS PERKG	3.51
0.717 kg NET @ \$4.90/kg	
BANANAS PERKG	2.44
0.976 kg NET @ \$2.50/kg	
GARLIC	1.28
0.051 kg NET @ \$25.00/kg	
CELERY 1EACH	4.50
RED GRAPES PERKG	4.17
1.070 kg NET @ \$3.90/kg	
RED GRAPES PERKG	4.04
1.035 kg NET @ \$3.90/kg	
RUBY RED GRAPEFRUIT PERKG	3.36
0.746 kg NET @ \$4.50/kg	

Carry out a. to e. from Part 1 for this list. Briefly discuss the accuracy of the estimate for Part 2.

Rounds items down to the nearest dollar and adds to form an under-estimate of 78

**A form an under estimate**

\$

9.00 rounds to \$9.00  
 2.00 rounds to \$2.00  
 7.00 rounds to \$7.00  
 10.00 rounds to \$10.00  
 3.68 rounds to \$3.00  
 5.00 rounds to \$5.00  
 2.85 rounds to \$2.00  
 6.00 rounds to \$6.00  
 5.62 rounds to \$5.00  
 4.00 rounds to \$4.00  
 4.50 rounds to \$4.00  
 4.91 rounds to \$4.00  
 3.51 rounds to \$3.00  
 2.44 rounds to \$2.00  
 1.28 rounds to \$1.00  
 4.50 rounds to \$4.00  
 4.17 rounds to \$4.00  
 4.04 rounds to \$4.00  
 3.36 rounds to \$3.00

\_\_\_\_\_ equals 78

**B form an over estimate**

\$

9  
 2  
 7  
 10  
 4  
 5  
 3  
 6  
 6  
 4  
 5  
 5  
 4  
 3  
 2  
 5  
 5  
 4  
 3

\_\_\_\_\_ = 94

**C form an estimate of total price**

\$

9  
 2  
 7  
 10  
 4  
 5  
 3  
 6  
 6  
 4  
 5  
 5  
 4  
 3

\_\_\_\_\_ = 89

Rounds items up to the nearest dollar to form an over-estimate of 94

Rounds items to the nearest dollar to form an estimate in between under- and over-estimate

# Mathematics – Annotated student work samples

total

$$\frac{87.86}{\text{used calculator}}$$

Uses a calculator to correctly calculate the actual total of the items, without \$ symbol

e) calculate percentage error.

Follows algorithm to accurately calculate percentage error

Step ①  
calculate difference

Calculates the difference as a positive value

difference 1.14

Step ② divide difference by actual value

Divides correct values

$$\frac{1.14}{89} = 0.01280989$$

Multiplies by 100 to correctly calculate percentage error, without rounding or percentage symbol

Step ③ times answer for step ② by 100

1.2808989

The accuracy of the estimate for part ② was not as good as the accuracy of the estimate for part ①. It had a difference of 1.14, while the other part (part ①) had a difference of 0.39.

Correctly interprets percentage error results, comparing results from parts 1 and 2 and identifying the lower decimal as a more accurate estimate

# Mathematics – Annotated student work samples

Carry out a. to d. from Part 1 for this list. Briefly discuss the accuracy of the estimate for Part 2.

a underestimate:	b. overestimate	c estimate	d
90	90	590	90
20	20	20	20
70	70	70	70
7100	9100	7100	1000
30	40	37	368
50	50	50	500
20	30	29	285
60	60	60	600
50	60	56	562
40	40	40	400
40	50	45	450
40	50	49	491
40	40	35	351
30	30	24	244
20	20	13	128
10	20	45	450
40	50	42	417
40	50	40	404
40	50	+ 34	+ 336
+ 30	+ 40	\$ 87.90	\$ 87.86
<u>820</u>	\$ 94.00	(calculator)	(calculator)
\$82.0 (calculator)	(calculator)		

e.  
 SF1  $87.90 - 87.86 = 0.04$   
 SF2  $0.4 \div 87.86$  (calculator)  $= 0.004552697$   
 SF3  $0.004552697 \times 100 = 0.4552697$  (moved decimal to places right)  
 rounded = 0.4%

MY ESTIMATE WAS VERY ACCURATE

Rounds items down to the nearest dollar to form an under-estimate

Rounds items up to the nearest dollar to form an over-estimate

Rounds items to the nearest tenth for in-between estimate

Aligns and calculates all working vertically

Checks answers for accuracy with a calculator

Calculates percentage error as an over-estimate, using the correct algorithm

Rounds to one decimal place and uses percentage symbol

Correctly interprets percentage error

# Mathematics – Annotated student work samples

Carry out a. to e. from Part 1 for this list. Briefly discuss the accuracy of the estimate for Part 2.

A:  $9.00 + 2.00 + 7.00 + 10.00 + 3.60 + 5.00 + 2.80 + 6.00 + 5.60 + 4.00 + 4.50 + 4.90 + 3.50 + 2.40 + 1.20 + 4.50 + 4.10 + 4.00 + 3.30 = 82.5$

My underestimate is 82.5

B:  $9.00 + 2.00 + 7.00 + 10.00 + 3.70 + 5.00 + 2.90 + 6.00 + 5.70 + 4.00 + 4.50 + 5.00 + 3.60 + 2.50 + 1.30 + 4.50 + 4.20 + 4.10 + 3.40 = 88.4$

My overestimate is 88.4

C:  $9.00 + 2.00 + 7.00 + 10.00 + 3.70 + 5.00 + 2.90 + 6.00 + 5.60 + 4.00 + 4.50 + 4.90 + 3.50 + 2.40 + 1.30 + 4.50 + 4.20 + 4.00 + 3.40 = 87.9$

My estimate is 87.9

D:  $9.00 + 2.00 + 7.00 + 10.00 + 3.68 + 5.00 + 2.85 + 6.00 + 5.62 + 4.00 + 4.50 + 4.91 + 3.54 + 2.44 + 1.28 + 4.50 + 4.17 + 4.04 + 3.36 = 87.86$

E:  $87.9 - 87.86 = 0.04$

$0.04 \div 87.86 = 0.00045526974 \times 100$

$0.045526974$  rounded to 1dp =

0.0

Rounds items down to the nearest 10 cents to form an under-estimate

Rounds items up to the nearest 10 cents to form an over-estimate

Rounds items to the nearest 10 cents and adds the items using a calculator

Correctly adds actual cost using a calculator

Correctly calculates percentage error to one decimal place, without the percentage symbol, using the given algorithm

# Mathematics – Annotated student work samples

Rounds items down to the nearest whole dollar to form an under-estimate

Rounds items up to the nearest whole dollar to form an over-estimate

Calculates the difference, and uses the middle value between the under- and over-estimate to form an estimate in the middle

Carry out a. to e. from Part 1 for this list. Briefly discuss the accuracy of the estimate for Part 2.

a)  $\$82$

9	11
2	18
7	28
10	31
3	36
5	38
2	44
6	49
5	53
4	57
4	61
3	64
2	66
1	67
4	71
4	75
4	79
3	82

b)  $9 = 94$

2	11
7	18
10	28
4	32
5	37
3	40
6	46
6	52
4	56
5	61
4	66
4	70
3	73
2	75
5	80
5	85
4	90
4	94

c) difference =  $94 - 82 = 12$   
 $12 \div 2 = 6$   
 $82 + 6 = 88$  avg.

d)

9.00	4.04
2.00	3.36
7.00	<u>87.86</u>
10.00	
3.68	
5.00	
2.85	
6.00	
5.62	
4.00	
4.50	
4.91	
3.51	
2.44	
1.28	
4.50	
4.17	

e) Step 1.  
 $88 - 87.86 = 0.14$   
 Step 2.  
 $0.14 \div 87.86 = 0.0015$   
 Step 3.  $0.0015 \times 100 = 0.1$   
 0.1%

Correctly calculates percentage error

Rounds answer to one decimal point incorrectly

Adds up all items vertically with a running total recorded



# Mathematics – Annotated student work samples

Correctly uses 'approximate' symbol ( $\approx$ )

Rounds items to the nearest \$ to form an over- and under-estimate

Uses a calculator to find each total

Carry out a. to e. from Part 1 for this list. Briefly discuss the accuracy of the estimate for Part 2.

Item:	Actual \$	\$ Under..	\$ Over..
A	9.00 $\approx$	9.00	9.00
B	2.00 $\approx$	2.00	2.00
C	7.00 $\approx$	7.00	7.00
D	10.00 $\approx$	10.00	10.00
E	3.68 $\approx$	3.50	4.00
F	5.00 $\approx$	5.00	5.00
G	2.85 $\approx$	2.50	3.00
H	6.00 $\approx$	6.00	6.00
I	5.62 $\approx$	5.50	6.00
J	4.00 $\approx$	4.00	4.00
K	4.50 $\approx$	4.50	4.50
L	4.91 $\approx$	4.50	5.00
M	3.51 $\approx$	3.50	4.00
N	2.44 $\approx$	2.00	2.50
O	1.28 $\approx$	1.00	1.50
P	4.50 $\approx$	4.50	4.50
Q	4.17 $\approx$	4.00	4.50
R	4.04 $\approx$	4.00	4.50
S	3.36 $\approx$	3.00	3.50

$$\begin{aligned}
 a. &= 9 + 2 + 7 + 10 + 3.5 + 5 + 2.5 + \\
 &6 + 5.5 + 4 + 4.5 + 4.5 + 3.5 + 2 + 1 + \\
 &4.5 + 4 + 4 + 3 \\
 &= 85.5 \quad \text{\$85.50}
 \end{aligned}$$

$$\begin{aligned}
 b. &= 9 + 2 + 7 + 10 + 4 + 5 + 3 + 6 + 6 + 4 + \\
 &4.5 + 5 + 4 + 2.5 + 1.5 + 4.5 + \\
 &4.5 + 4.5 + 3.5 \\
 &= 87.5 \quad \text{\$87.50}
 \end{aligned}$$

$$\begin{aligned}
 c. & (85.5 + 87.5) \div 2 = 86.5 \\
 & \text{\$86.50}
 \end{aligned}$$

$$\begin{aligned}
 d. &= 9 + 2 + 7 + 10 + 3.68 + 5 + \\
 &2.85 + 6 + 5.62 + 4 + 4.5 + 4.91 + \\
 &3.51 + 2.44 + 1.28 + 4.5 + \\
 &4.17 + 4.04 + 3.36 \\
 &= 76.13 \quad \text{\$76.13}
 \end{aligned}$$

e. Uses symbols to assist calculation

$$\begin{aligned}
 \text{Step 1: } E - AV &= D \\
 \$86.5 - \$76.13 &= \$10.73
 \end{aligned}$$

$$\begin{aligned}
 \text{Step 2: } D \div AV &= A \\
 \$10.73 \div \$76.13 &= 0.140943124
 \end{aligned}$$

$$\begin{aligned}
 \text{Step 3: } A(52) \times 100(\%) &= FA \\
 0.140943124 \times 100 &= 14.0943124\%
 \end{aligned}$$

Uses the given algorithm to identify percentage error as a positive number with percentage symbol

### Where to next for the teacher?

When the task on which these annotated student work samples is based has been used as a classroom activity, there is opportunity to gather data on student achievement and to help inform further teaching.

An analysis of student responses, on an individual, group or whole class basis, can be used to develop and direct student learning with respect to the following content.

### For students needing to review underpinning knowledge and skills at [Level 6](#)

- Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers and make estimates for these computations (VCMNA209)
- Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers (VCMNA214)

### For students consolidating knowledge and skills at [Level 7](#)

- Investigate and calculate 'best buys', with and without digital technologies (VCMNA250)

### For students moving on to new knowledge and skills at [Level 8](#)

- Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies and make estimates for these computations (VCMNA273)
- Solve problems involving the use of percentages, including percentage increases and decreases and percentage error, with and without digital technologies (VCMNA276)
- Use algorithms and related testing procedures to identify and correct errors (VCMNA282)

### Resources

- [Numeracy Learning Progressions](#), Victorian Curriculum and Assessment Authority (VCAA) – The Numeracy Learning Progressions amplify, extend and build on the numeracy skills in the Victorian Curriculum F–10: Mathematics and support the application of numeracy learning within other learning areas.
- [FUSE](#), Victorian Department of Education and Training (DET) – The FUSE website provides access to digital resources that support the implementation of the Victorian Curriculum F–10, including an extensive range of activities and other resources for [Primary Mathematics](#) and [Secondary Mathematics](#).
- [Mathematics Curriculum Companion](#), Victorian Department of Education and Training (DET)
- [Aligned Australian Curriculum Resources \(Mathematics\)](#), Australian Curriculum, Assessment and Reporting Authority (ACARA)