

# Electro Critical Skills Resource Suite



## Entry Level Literacy and Numeracy Assessment for the Electrotechnology Trades

### Enrichment Resource

#### UNIT 5: Estimation



managing apprentice progression

An E-Oz Energy  
Skills Australia project.



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## ESTIMATION

In mathematics, to estimate means to form an approximate opinion of size, amount or number that is sufficiently exact for your specific purpose.

By estimating the answer to a problem, you have a way of checking if your actual answer is right or wrong. Even when using a calculator it is possible to push a wrong key and obtain an incorrect answer. Approximating enables you to quickly check your calculations or to project what an answer might be.

## LEARNING OUTCOME

- Can estimate the answer to mathematical problems.

## PERFORMANCE CRITERIA

- Rounds off whole numbers and decimals to defined place value.
- Selects a reasonable answer without doing the precise calculations.
- Uses approximation techniques to validate calculations.



# ESTIMATION

## EXERCISE 1

Estimate answers to the following problems by using your general knowledge. (Remember in this case the true value is not important.)

a) The time taken to travel from work to the city by car?

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b) The average cost per month of electricity for a suburban

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c) The safe load limit for an elevator that allows 12 people to ride in it at one time?

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d) The weight of a 100 metre drum of 2.5mm<sup>2</sup> cable?

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## ROUNDING OFF

In maths problems, if you 'round off' numbers to the nearest ten, hundred or thousand, you can work with the numbers more easily.

By 'rounding off' we mean changing the number to the nearest rounded number. Rounded numbers are approximate numbers.

## ROUNDING WHOLE NUMBERS

- Rounding to the nearest ten. When rounding to the nearest ten we look at the digit in the units place.

Numbers ending in **5 or more** are rounded to the nearest **10 above**

47 → 50	39 → 40
55 → 60	187 → 190
29 → 30	

Numbers ending in **4 or less** are rounded to the nearest **10 below**

32 → 30	23 → 20
84 → 80	164 → 160
91 → 90	

- Rounding to the nearest 100. Look at the digit in the ten's place.

Numbers which have **5 or more** are rounded to the **next 100**

356 → 400	297 → 300
456 → 500	1068 → 1100
882 → 900	

Numbers which have **4 or less** are rounded down to the **nearest 100**

142 → 100	611 → 600
233 → 200	1323 → 1300
539 → 500	

Rounding to the nearest thousand, look at the digits in the 100's place.

**Round up** those **5 and more**, **round down** those **4 and less**.

eg.     1423 is closer to 1000 than 2000  
       2702 is closer to 3000 than 2000

## USING ESTIMATION INVOLVING WHOLE NUMBERS

Is the answer reasonable? Check the calculator answers to the following questions by estimating.

- a)                       $276 \div 25$                       Calculator answer: 11.04  
     Estimate            $300 \div 30 = 10$   
                             The answer **is reasonable**.

- b)                       $53 \times 121$                       Calculator answer: 6413  
     Estimate            $50 \times 100 = 5000$   
                             The answer **is not reasonable**

### Example 1

If an electric stove uses 1600 watts per hour, how many watts would be used in 148 hours?

$$1600W \times 148 \approx 2000W \times 200 = 400,000W$$

**Note:**                 $\approx$  is the symbol for approximately equal to.

**ANSWER:**        The electric stove would use approximately 400,000 watts in 148 hours.

## ROUNDING DECIMALS

When rounding a decimal number the same rules apply. The degree of accuracy obtained in a decimal number is generally correct to 2 decimal number places. This means that we look at the digit in the 3rd decimal place.

Nearest Hundredth	
$3.256 \rightarrow 3.26$	$3.873 \rightarrow 3.87$
$12.367 \rightarrow 12.37$	$27.274 \rightarrow 27.27$
$369.885 \rightarrow 369.89$	$608.851 \rightarrow 608.85$

When estimating answers involving decimals it is easiest to round up or down the number so that you are dealing with tens, hundreds etc.

### Example 1

$$36.25 \times 399.87 \approx 40 \times 400 = 16,000$$

**Note:**  $\approx$  means approximately equal to.

$$36.25 \times 399.87 \approx 16,000$$

### Example 2

$$1,533.12 \div 4.8 \approx 1500 \div 5 = 300$$

$$1533.12 \div 4.8 \approx 300$$

## EXERCISE 2

In each of the following problems use your calculator to find the exact answers and compare them to your estimates.

**Estimate by rounding to the nearest ten.**

	Round Nos.	Estimate	Actual
eg. $104 + 67$	$100 + 70$	170	171
a) $76 \div 17$			
b) $107 - 11 - 55$			
c) $28 \times 13$			

**Estimate by rounding to the nearest 100.**

	Round Nos.	Estimate	Actual
d) $692 + 8563$			
e) $4762 - 2087$			
f) $488 \times 2311$			
g) $7653 \div 182$			

**Estimate by rounding to the nearest whole number**

	Round Nos.	Estimate	Actual
h) $2.8 + 7.9$			
i) $19.33 - 6.81$			
j) $4.16 \times 3.83$			
k) $9.991 \div 1.84$			



### EXERCISE 3

The following answers to the listed problems came up on the calculator. By using estimation check to see if they are reasonable. Mark with a ✓ those that are reasonable and a ✗ those that are not.

Problem	Calculator Answer	✓ or ✗	Estimate
a) $57.7\text{V} \times 2.23\text{A}$	128.67 watts		watts
b) $863 \times 48$	41424		
c) $6881\text{V} \div 3.6\text{A}$	191.390Ω		Ω
d) $1417 \div 16.03$	88.40		$1400 \div 20 = 70$
e) $64,564\Omega + 122,038\Omega + 101,416\Omega + 5,900\Omega =$	4939180Ω		Ω

### EXERCISE 4

An electrician is employed to wire sixteen identical residential units. Each unit requires seventy-two metres of  $2.5\text{mm}^2$  cable to wire the power circuits. The cable is sold on 100 metre drums.

Estimate how many drums of  $2.5\text{mm}^2$  cable are required to wire the power circuits in all of the units.

### EXERCISE 5

It is now 12:30pm. You are 250km from Melbourne. Is it possible for you to be in Melbourne to start a job at 3:00pm, assuming that you drive an average rate of 95km per hour?

### EXERCISE 6

If a household uses an average of 3700 watts per hour, estimate how many watts are used in a year.

### EXERCISE 7

An electrician requires 230 metres of PVC conduit for a job. He has 6 bundles of conduit in stock. Each bundle consists of ten lengths of conduit 4 metres long.

Use estimation to determine whether the electrician has enough conduit for the job.

### EXERCISE 8

If the power in one transmission line is 112.5 watts, estimate the total power in 63 of the same transmission lines.



Use the answer sheet to check your work.

# ANSWERS

## EXERCISE 1

- a. eg. St Kilda to the city by car.  
Estimate - 10 minutes.
- b. Average monthly cost of electricity for a suburban household.  
Estimate - \$60
- c. Safe load limit for an elevator.  
Estimate - 2,000kg.
- d. Weight of a 100 metre drum of  $2.5\text{mm}^2$  cable.  
Estimate - 100 kg.

## EXERCISE 2

**Estimate by rounding to the nearest ten.**

	Round Nos.	Estimate	Actual
eg. $104 + 67$	$100 + 70$	170	171
a) $76 \div 17$	$80 \div 20$	4	4.47
b) $107 - 11 - 55$	$110 - 10 - 60$	40	41
c) $28 \times 13$	$30 \times 10$	300	364

**Estimate by rounding to the nearest 100.**

	Round Nos.	Estimate	Actual
d) $692 + 8563$	$700 + 8600$	9800	9255
e) $4762 - 2087$	$4800 - 2100$	2700	2675
f) $488 \times 2311$	$500 \times 2300$	1150,000	1,127,768
g) $7653 \div 182$	$7700 \div 200$	38	42.05

**Estimate by rounding to the nearest whole number**

	Round Nos.	Estimate	Actual
h) $2.8 + 7.9$	$3 + 8$	11	10.7
i) $19.33 - 6.81$	$19 - 7$	12	12.52
j) $4.16 \times 3.83$	$4 \times 4$	16	15.93
k) $9.991 \div 1.84$	$10 \div 2$	5	5.43

### EXERCISE 3

Problem	Calculator Answer	✓ or X	Estimate
a) $57.7V \times 2.23A$	128.67 watts	✓	$60 \times 2.120\text{watts}$
b) $863 \times 48$	41424	✓	$900 \times 50 = 45,000$
c) $6881V \div 3.6A$	191.390Ω	X	$7000 \div 4 = 1750\Omega$
d) $1417 \div 16.03$	88.40	✓	$1400 \div 20 = 70$
e) $64,564\Omega + 122,038\Omega + 101,416\Omega + 5,900\Omega =$	4939180Ω	X	$70,000\Omega$ $120,000\Omega$ $100,000\Omega$ $6,000\Omega$ <u>296,000Ω</u>

### EXERCISE 4

$$16 \times 72 \approx 20 \times 70 = 1400$$

Estimate: 1400 metres to wire 16 units

$$1400 \div 100 = 14$$

Estimate: 14 drums required

### EXERCISE 5

$$250 \div 95 \approx 300 \div 100 = 3$$

Estimate: 3 hours to drive to Melbourne

Answer: It is unlikely that you would be able to start the job in Melbourne.

### EXERCISE 6

$$3700 \times 24 \approx 3700 \times 20 = 74\,000 \text{ watts per day}$$

$$74\,000 \times 7 = 518\,000 \text{ watts per week}$$

$$518\,000 \times 4 = 2\,072\,000 \text{ watts per month}$$

$$2\,072\,000 \times 12 \approx 2\,072\,000 \times 10 = 20\,720\,000 \text{ watts per year}$$

Estimate: 20 720 000 watts used by the household in a year.

### EXERCISE 7

$$6 \times 10 \times 4 = 60 \times 4 = 240 \text{ metres in stock}$$

Yes, there is enough PVC conduit for the job.

### EXERCISE 8

$$112.5 \times 63 \approx 110 \times 60 = 6600$$

Estimate: 6600 watts in 63 transmission lines.