BOOK 6 - MEASUREMENT
Mass, Capacity and Time

MATHS MATE

BLUE

A. Lorimer-Derham I. Tutos J. B. Wright

BOOK 6 - MEASUREMENT

Mass, Capacity and Time

Sample pages include:

MATHS MATE BLUE - BOOK 6
Measurement - Mass, Capacity and Time

Key: Confused — Need help — Confident — Understood

After completing each lesson, place a ✕ on the appropriate traffic light to indicate how well you understood this work.

RACE AROUND THE WORLD

The Blu-Tang Clan have entered the *'Race Around the World'* challenge to raise money to help protect their reef.

Your task is to guide them to victory.

Flight	Departures		Duration
A - L	06:30	14:40	14:30
A - M	18:30		15:40
B - D	09:20	23:10	08:00
B - N	11:50	17:30	09:10
B - K	08:50		04:40
C - D	12:30	22:50	05:40
C - S	05:10	11:20	05:10
D - C	07:20	15:20	05:40
D - G	06:40	20:10	08:20
D - S	07:00	17:50	08:50
D - O	06:30	12:40	10:20
G - D	11:20	18:00	08:20
G - N	14:30	19:10	08:30
G - K	09:40	13:00	04:15
H - S	09:00	10:30	04:40

Flight	Departures		Duration
H - O	10:10	23:00	05:10
J - L	05:50	11:20	05:30
J - M	15:00		04:20
J - N	06:10	14:30	03:30
K - B	07:30		04:40
K - G	04:50	11:00	04:15
L - A	11:40	16:20	14:30
L - J	08:00	13:10	05:30
L - M	09:30		04:40
L - N	08:50	13:00	05:50
M - J	12:20	16:40	04:20
M - L	04:00	12:10	04:40
M - R	07:40	19:40	11:40
N - B	07:50	14:50	09:10
N - G	11:20	15:00	08:30

Flight	Departures		Duration
N - J	05:30	16:30	03:30
N - L	09:20	19:00	05:50
N - R	14:10	18:10	11:10
O - D	06:00	11:20	11:20
O - H	08:40	10:50	05:10
P - S	12:20	14:10	06:20
P - T	06:40		05:00
R - B	10:20	20:00	12:10
R - N	07:00	15:30	11:10
S - C	06:40	14:50	05:10
S - H	09:40	13:20	04:40
S - P	07:30	16:00	06:20
S - T	10:10	20:00	09:00
T - A	09:20		04:50
T - P	07:40	17:10	05:00

Instructions:
Using the departures table, plan the fastest route to your destination. You can make as many stop overs as you like. Each destination is identified by a drop pin.

Flight: **A-L** represents flights from Auckland to Los Angeles.
Departures: Departure times use 24-hour Greenwich Mean Time (GMT). Times are the same each day of the week. Some destinations have two flights per day, others, only one.
Duration: 14:30 means it will be 14 hours and 30 minutes before you can catch another flight. The time includes an hour to allow for transferring to connecting flights and customs clearance.

The leading competitor times for each race are given. They are all beatable, so happy travels!
[Note: Not all flight paths are two way.]

Example:
You are in a race from Dubai to Hong Kong. The race begins in Dubai at 06:00 on Sunday. What is the fastest route?

Flight	Depart	Duration	Arrive
D-O	*06:30 Sun*	*10:20*	*16:50 Sun*
O-H	*08:40 Mon*	*05:10*	*13:50 Mon*

3 *D-O-H is the fastest route arriving at 13:50 on Monday.*

1. You are in a race from New York to Dubai. The race begins in New York at 17:30 on Friday. What is the fastest route?

Flight	Depart	Duration	Arrive

Competitors times:

Aphra Behn	13:00 Sun
Xuanzang	19:40 Sun
Ernest Hemingway	13:00 Mon

2. You are in a race from Los Angeles to Rio de Janeiro. The race begins in Los Angeles at 07:30 on Tuesday. What is the fastest route?

Flight	Depart	Duration	Arrive

Competitors times:

Amy Johnson	07:20 Wed
Amelia Earhart	05:20 Thu
Charles Lindbergh	07:20 Thu

6.2 UNITS OF MASS

6.2.1 Estimating Mass

Describe how you would make an accurate estimate of how heavy your school bag was this morning.

Use the following tips to help you estimate the mass of an object:

- Choose the most appropriate units: grams (g), kilograms (kg), or tonnes (t).
- Think of an object of a similar mass. Multiples of an object might be appropriate, eg. If you know that a 200 g packet contains 10 identical biscuits, then you can estimate the weight of 1 biscuit.
- Alternatively, think of two objects you are familiar with, one lighter and one heavier. Your estimate should be somewhere in between.

1. Which of these objects are likely to have a mass more than 1 kilogram?

- [ ] A mobile phone
- [✓] A full suitcase
- [ ] A bar of soap
- [✓] A bicycle

Compare the mass of each object to that of a standard one that you already know e.g. 1 kilogram of flour. Only the suitcase and bicycle would be likely to have a mass of more than 1 kilogram.

2. Which of these objects are likely to have a mass greater than 1 tonne?

- [ ] A dump truck
- [ ] A motorbike
- [ ] A passenger jet
- [ ] A kayak

3. Which of these objects are likely to have a mass less than 1 kilogram?

- [ ] A dozen eggs
- [ ] A block of chocolate
- [ ] A loaf of bread
- [ ] A large box of washing powder

4. Which of these objects are likely to have a mass less than 1 gram?

- [ ] A grain of salt
- [ ] An apple
- [ ] A walnut
- [ ] A banana

5. Which of these objects are likely to have a mass more than 1 gram?

- [ ] A grain of sugar
- [ ] A marble
- [ ] A pen
- [ ] A shoe

6. Which of these objects are likely to have a mass less than 1 tonne?

- [ ] An ocean liner
- [ ] A helium balloon
- [ ] A Great Dane
- [ ] A motorbike

7. Which of these objects are likely to have a mass less than 10 kilograms?

- [ ] A couch
- [ ] A tub of ice cream
- [ ] A jet ski
- [ ] A pair of rollerblades

8. Which of these objects are likely to have a mass more than 10 kilograms?

- [ ] A chicken
- [ ] A horse
- [ ] A cow
- [ ] A duck

9. Choose the appropriate unit to complete the statements: grams, kilograms or tonnes.

a) The total amount of salt a healthy person should eat each day is 6...

grams

The weight of the nutritional elements of food are usually measured in grams or milligrams. Compare the amount of salt to known amounts of a single unit e.g. 1 kilogram of sugar or a 1 tonne truck.

b) The blue whale is the heaviest animal in the world and weighs about 120...

c) The average amount of rubbish produced by every Australian each year is 1...

d) A typical dairy cow weighs approximately 700...

e) The amount of sugar in a typical soft drink can is 40...

f) The 797F, Caterpillar's largest mining dump truck, has a payload of 400...

g) The carry on baggage allowance on an airline is 7...

h) A typical mobile phone weighs approximately 180...

i) The largest pumpkin ever grown in Australia weighed 867...

j) The average weight of a single seedless grape is 5...

Sudo-clue: #02

In this sudo-clue the three rows (left to right) and three columns (top to bottom) make six 3-digit numbers. Each number represents the weight in kilograms of six cattle: two bulls, two cows and two calves. The photo below shows, from left to right, the heavier bull, the heavier cow, and the lighter calf.

Place the numbers 0 to 8 (not 1 to 9) on the grid using these clues about the six weights:

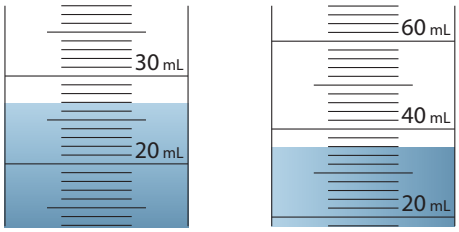
1. The weight of the heaviest bull is exactly twice that of the lighter cow.
2. The lighter bull weighs $^{3}/_{4}$ of a tonne. His weight runs horizontally.
3. The lighter calf weighs $^{1}/_{8}$ of a tonne.

	1	2	3
A			
B			
C			

6.5 BOOK 6 - Mass, Capacity and Time REVIEW

Multiple Choice

1. How much more water is in the second cylinder?



A 8 mL **B** 14 mL **C** 12 mL **D** 9 mL

2. What time is shown on the clock?

A 8:20

B 3:40

C 4 past 8

D 8 to 4

3. Convert 17:40 to am/pm time.

A 1:40 pm **B** 7:20 am

C 5:20 am **D** 5:40 pm

4. What is 12:15 am in 24-hour time?

A 12:15 **B** 01:15 **C** 00:15 **D** 11:15

5. Which sentence is true?

Eastern Suburbs & Illawarra Line *to Bondi Junction Weekdays*			
Redfern	4:39 am	4:49 am	5:04 am
Central	4:42 am	4:52 am	5:07 am
Town Hall	4:44 am	4:54 am	5:09 am
Martin Place	4:46 am	4:56 am	5:11 am
Kings Cross	4:48 am	4:58 am	5:13 am
Edgecliff	4:50 am	5:00 am	5:15 am
Bondi Junction	4:53 am	5:03 am	5:18 am

A The longest time between stops is 5 min.

B The total trip from Redfern to Bondi Junction is 14 minutes.

C Trains arrive at each station every 10 minutes.

D It takes 19 minutes to travel from the Town Hall to Bondi Junction.

6. The amount of sugar in a regular teaspoon is 4 ____.

A mg **B** g **C** kg **D** t

7. How many grams in 0.7 kilograms?

A 700 g **B** 0.07 g **C** 7000 g **D** 70 g

8. The average size of a medium rainwater tank is 6___.

A mL **B** L **C** kL **D** ML

9. How many litres in 2200 mL?

A 22 L **B** 0.22 L **C** 220 L **D** 2.2 L

10. How many seconds in 2 minutes and 40 seconds?

A 100 s **B** 120 s **C** 140 s **D** 160 s

11. How many days in 72 hours?

A 0.5 days **B** 1 day

C 2 days **D** 3 days

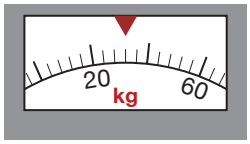
12. It is 8:40 pm. What was the time 6 hours ago?

A 2:40 am **B** 2:40 pm

C 4:40 pm **D** 4:40 am

Short Answer

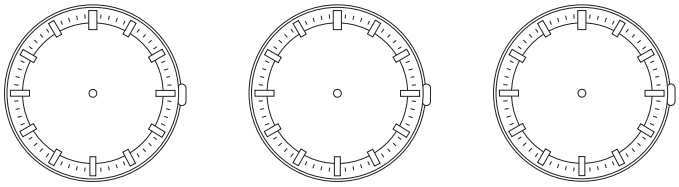
1. How many kg are shown on this scale?



2. At what speed is the car travelling?

3. Draw hands on the clock face to show these times:

a) 01:25 **b)** 08:05 **c)** 06:55



4. Express the time on this clock in digital form:

. . . . . .

5. Convert from am/pm to 24-hour time:

a) 12:30 pm = ... : . . . . .

b) 12:30 am = ... : . . . . .

c) 4:00 pm = ... : . . . . .

6. Express the following in am/pm and in 24-hour time:

a) **midday**

i) am/pm time . . . . . .

ii) 24-h time . . . . . .

b) **midnight**

i) am/pm time . . . . . .

ii) 24-h time . . . . . .

7. What time is the latest low tide on Wednesday, 28th of April 2021?

Mooloolaba Beach (QLD) Tide data:			
Tuesday 27th April 2021		Wednesday 28th April 2021	
1:51 am	0.31 m Low	2:41 am	0.33 m Low
7:53 am	1.67 m High	8:36 am	1.75 m High
2:01 pm	0.28 m Low	2:41 pm	0.21 m Low
8:24 pm	1.95 m High	9:10 pm	2.09 m High

. . . . . .

8. Convert the following units of mass:

a) 12 kg = ... g

b) 4 t = ... kg

c) 3000 mg = ... g

d) 7500 g = ... kg

9. Convert the following units of capacity:

a) 4 L = ... mL

b) 10 000 mL = ... L

c) 2 kL = ... L

d) 0.04 ML = ... L

10. Convert the following units of time:

a) 3 weeks 5 days = ... days

b) 600 minutes = ... h

c) 3 minutes = ... s

d) 1200 seconds = ... min

11. Some students left school to go to the city at 08:50 and returned at 15:00. How long was the trip in hours and minutes?

. . . . . .

12. Alex spends 1 hour and 20 minutes swimming each morning. He starts at 5:30 am. At what times does Alex hop out of the water?

. . . . . .

MONEY BOX CHALLENGE

Fit the greatest amount of money into the box below.
Shapes must not overlap or stick outside the box.

Each puzzle contains 4 x Hexagons, 16 x Triangles, 9 x Squares
Print, cut out and laminate shapes on the next page(s)

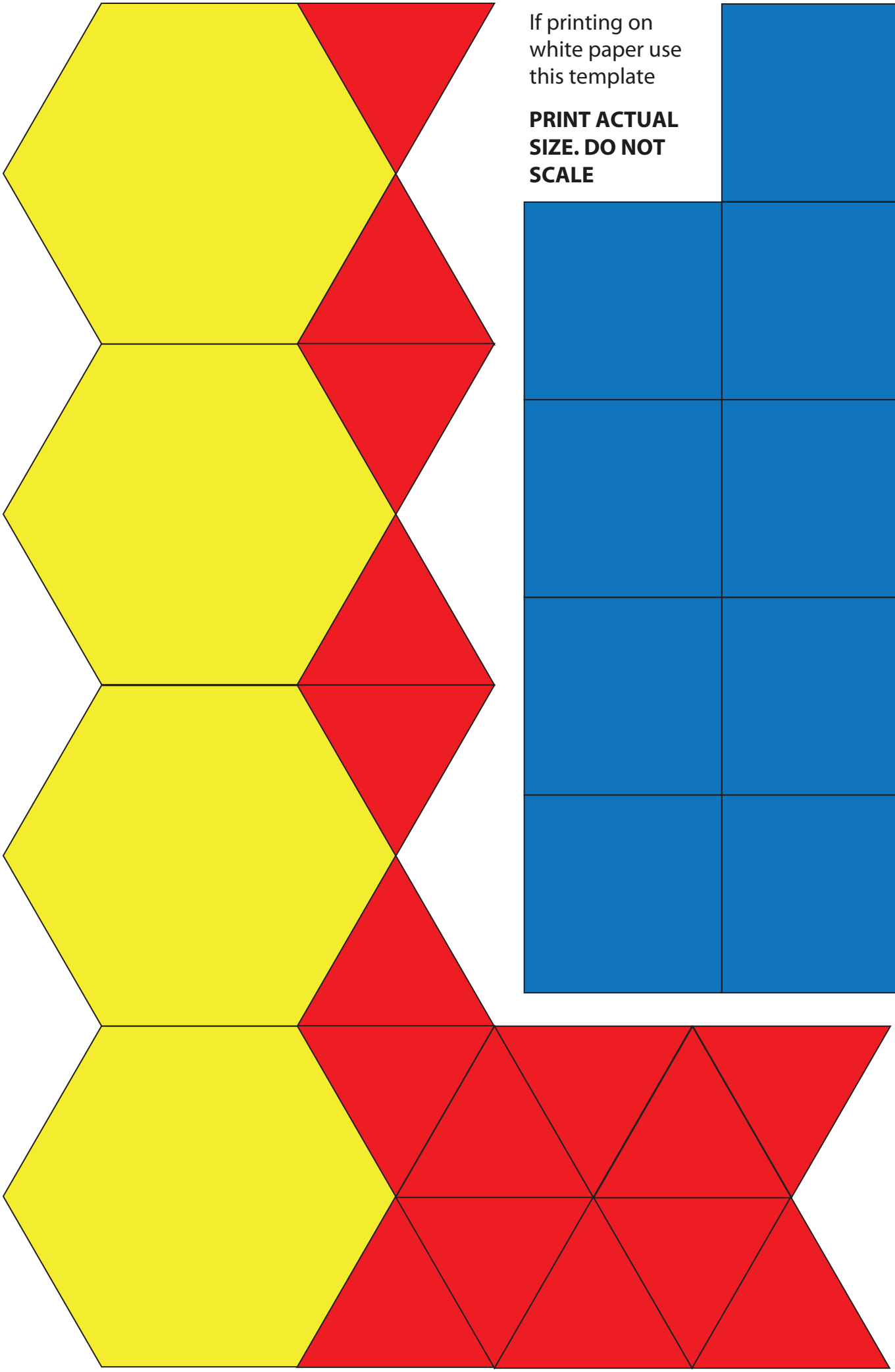
RANKING	TOTAL
Rookie	≥ $2.00
Novice	≥ $2.10
Advanced	≥ $2.20
Expert	≥ $2.30
Genius	≥ $2.35

THINK SQUARE
Intentional Fun

If you enjoyed this activity there are hundreds more games, puzzles and rich tasks like this in the Maths Mate Year 7-8 textbooks **mathsmate.net**

If printing on white paper use this template

PRINT ACTUAL SIZE. DO NOT SCALE



BOOK 7 - MEASUREMENT
Perimeter, Area and Volume

MATHS MATE

BLUE

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BOOK 7 - MEASUREMENT

Perimeter, Area and Volume

Sample pages include:

MATHS MATE BLUE - BOOK 7
Measurement - Perimeter, Area and Volume

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Pizza Delivery

You are training to become a delivery person at *Instant Pizza* where things happen fast. The pizzeria offers only one size and one flavour (Aussie), which means a speedy delivery and fresh pizza. Payment options are simple; all pizzas are just $10 and your tip is automatically calculated via the Instant Pizza app. No more awkward small talk at the front door! If an order takes more than 30 minutes, it's on the house.

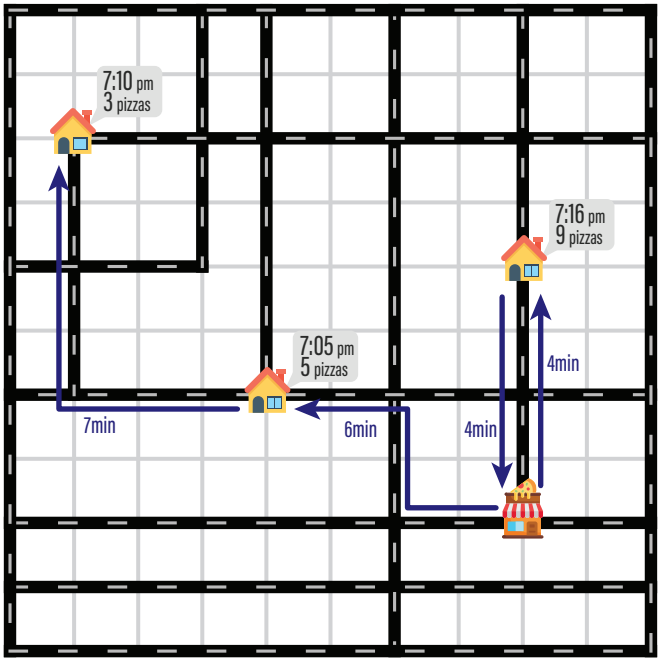
Delivery Rules:

- Start at the pizza store at the time indicated.
- Stay on the roads! Every road segment takes one minute.
- You can only carry up to 10 pizzas at a time.
- You must deliver to all customers and make each delivery in full. 7:36 pm 4 pizzas
- Tips are based on the time taken from when the pizza was ordered to its delivery.
  - 15 minutes or less, 10% tip
  - 16 to 20 minutes, 5% tip
  - 21 to 30 minutes, no tip
  - If you take longer than 30 minutes, you'll have $5 deducted from your pay!

Goal:

See how much you can earn in tips for each night! Prizes for the most badges earned are shown on page 33.

MONEY MONDAY



Current Time = **7:20pm**

Time of order	Time travelled	Time delivered	Waiting time	Cost of pizzas	Tip
7:16 pm	4 min	7:24 pm	8 min	$90	10% = $9
7:05 pm	10 min*	7:34 pm	29 min	$50	no tip
7:10 pm	7 min	7:41 pm	31 min	$30	penalty $5
	* via pizza shop			**Total tip**	$4

SOLUTION

Current time is 7:20 pm.
You deliver to the house with the order for 9 pizzas (7:16 pm).
Travel time from shop = 4 min
You started at 7:20 pm and arrive at 7:24 pm.
Waiting time for customer = 8 min
Your tip is 10% of the total cost of 9 pizzas, 10% of $90 = $9

You ride back to the shop to get more pizzas, and then deliver to the 7:05 pm order.
Travel time between deliveries = 10 min
You left at 7:24, so you arrive at 7:34 pm.
Waiting time for customer = 29 min
There is no tip but no penalty either.

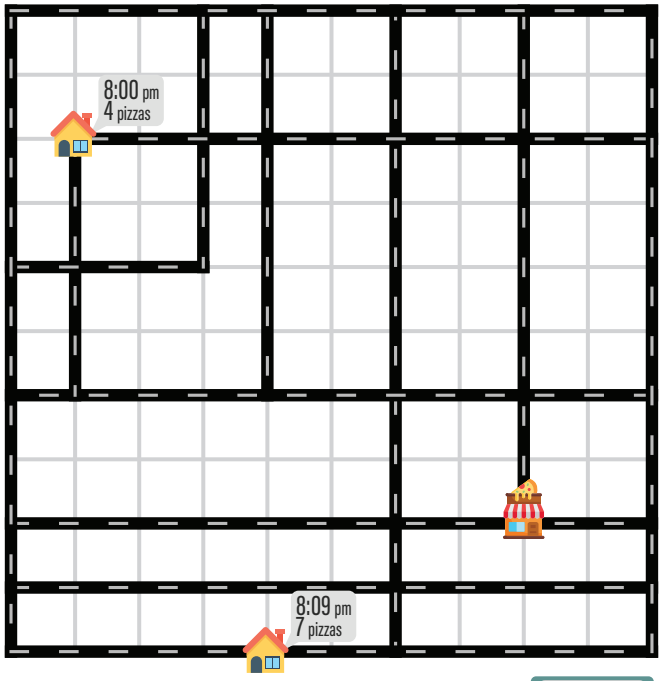
You have enough pizzas left in your bag to be able to deliver to the last house.
Travel time from second house = 7 min
You left at 7:34, so you arrive at 7:41 pm.
Waiting time for customer = 31 min
Oops! That's cost you a $5 penalty.

Your total tip for the night = $9 – $5 = $4

You have just earned 4 badges!

$4.00

TOUGH TUESDAY



Current Time = **8:12pm**

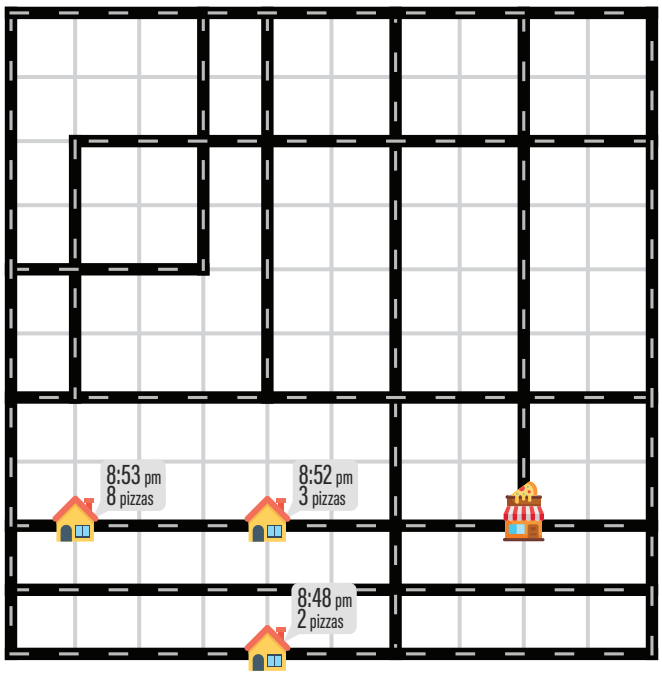
Time of order	Time travelled	Time delivered	Waiting time	Cost of pizzas	Tip

Total tip

How many badges did you earn?

4	$2.00
3	–$1.50
2	–$5.00
1	–$10.00

WONDERFUL WEDNESDAY



Current Time = **8:53pm**

Time of order	Time travelled	Time delivered	Waiting time	Cost of pizzas	Tip

Total tip

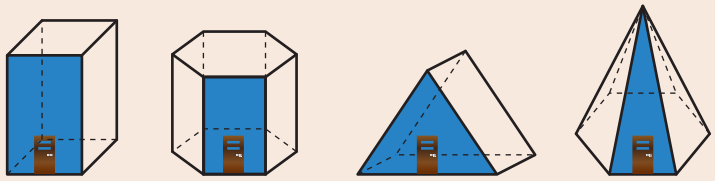
How many badges did you earn?

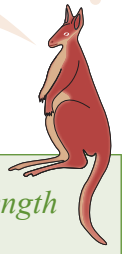
4	$11.00
3	$10.00
2	$9.50
1	$9.00

7.3.2 Calculating the Volume of Cubes and Rectangular Prisms

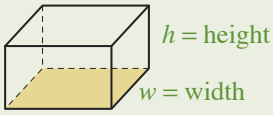
A multistorey library has 1000 books on the first floor. If the library had 6 levels you could accurately estimate that there are a total of 6000 books in the library. Draw a diagram of the building to demonstrate or describe a situation where this assumption might or might not be true.

Examples:





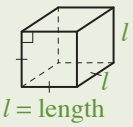
Volume of a rectangular prism = *length* × *width* × *height*



$V = l \times w \times h$
$= lwh$

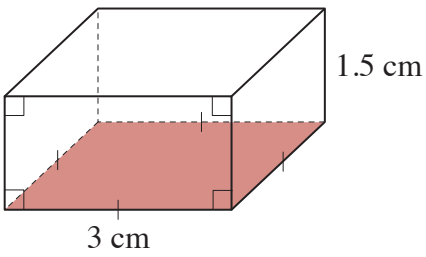
Volume of a cube = *length* × *length* × *length*
= *length cubed*

$V = l \times l \times l$
$= l^3$



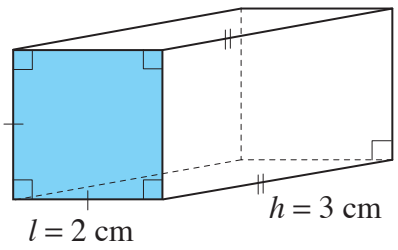
1. Using $V = l \times w \times h$ find the volume of the rectangular prisms.

a)

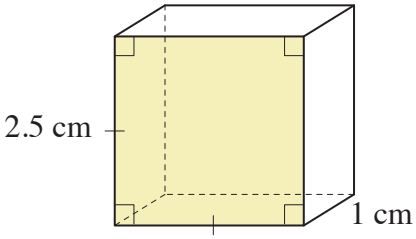


$V = l \times w \times h$ ($l = 3$, $w = 3$, $h = 1.5$)
$= 3 \times 3 \times 1.5$
$= 13.5\ cm^3$

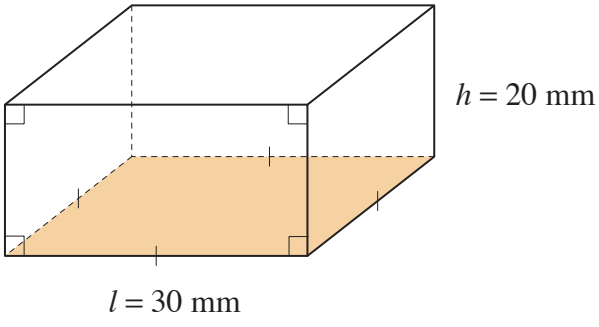
b)



c)

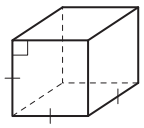


d)



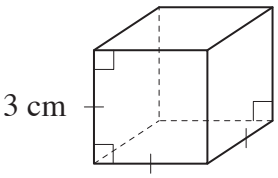
2. Using $V = l^3$ find the volume of the cubes.

a)

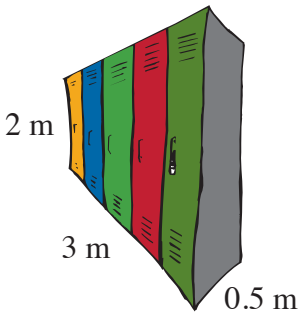


$l = 10$ mm

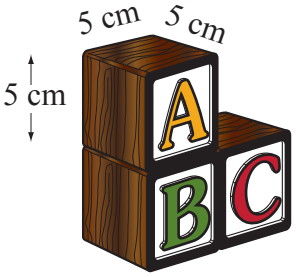
b)



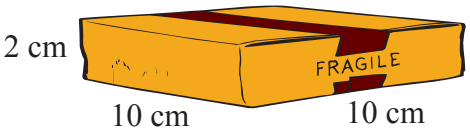
3. Find the volume of the bank of lockers in the shape of a rectangular prism.



4. Find the volume of the building block stack.



Quest 6 How many identical parcels like the one shown below can fit in a cube of side length 20 cm? [The parcel is in the shape of a rectangular prism.]



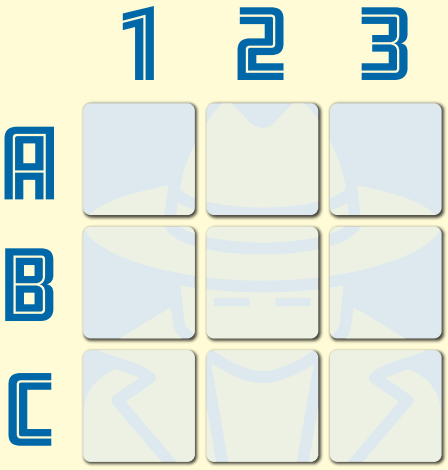
A 20 **B** 30 **C** 40 **D** 50 **E** 100 **F** 200

Now use the code breaker inside the back cover to obtain the last code letter.

Sudo-clue: #01

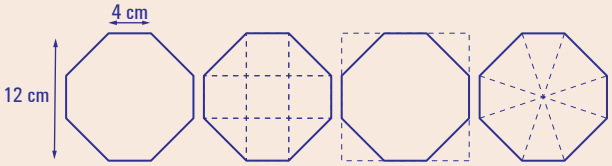
Place the numbers 1 to 9 on the grid using these clues:

1. The smallest number is in the bottom right hand corner.
2. The number to the left of the smallest number is 6 times larger than it.
3. The largest even number is in Row C.
4. The number above the 8 is six less than it.
5. The 3 is smaller than the numbers on its left and right.
6. The top right number is one more than the number below it.
7. The numbers in Row A add to 15.



7.2.6 Calculating the Area of Composite Shapes

Three students are trying to work out the area of an octagon.
Which method is easiest and why?

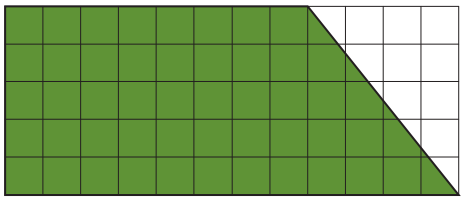


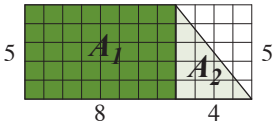
To calculate the area of composite shapes:

- Break the shape up into workable parts, such as squares, rectangles, triangles, parallelograms.
- Calculate the area of each part and add the results to find the total.

1. Find the area of the shaded polygons.

a)





break the shape into a rectangle and a triangle

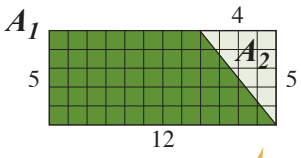
$A_1 = 8 \times 5 = 40$

$A_2 = \frac{1}{2} \times 4 \times 5 = 10$

$A = 40 + 10$

$A = 50$ sq. units

Or



surround the shape with a rectangle and subtract a triangle

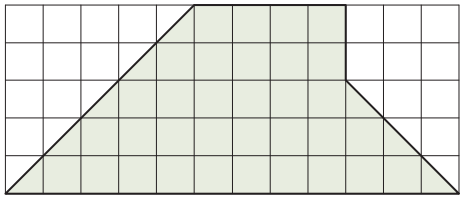
$A_1 = 12 \times 5 = 60$

$A_2 = \frac{1}{2} \times 4 \times 5 = 10$

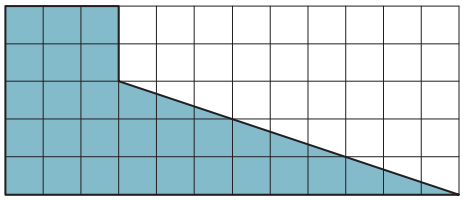
$A = 60 - 10$

$A = 50$ sq. units

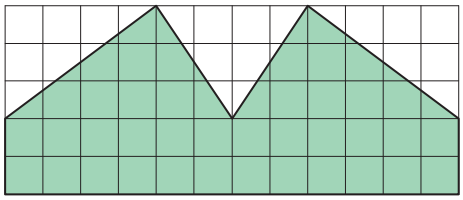
b)



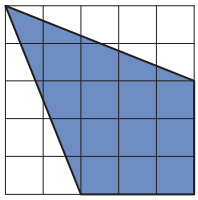
c)



d)



e)



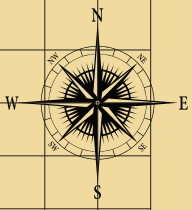
Treasure Island

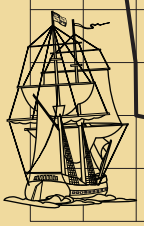
Captain John Silver has forgotten where he buried his treasure chest. He is trying to decide if it is worth hiring a team of diggers to find it. He calculates that it is only worthwhile if the island is no more than five hundred square chains in area. A chain being an old-fashioned distance equal to the distance between the stumps on a cricket pitch. Please, don't mention stumps to Mr Silver, he's very sensitive about this topic!

John has asked you to calculate the area of the island for him, and no one dares to knock back a request from JS! Divide the map into smaller, more manageable parts, e.g. triangles, squares, rectangles, etc. Add or subtract the area of these parts to calculate the area of the island.

What is your advice for Captain John Silver?

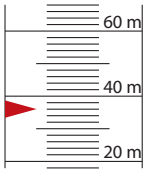
= 1 square chain





Multiple Choice

1. What is the measured length on the tape?

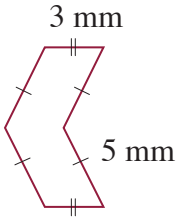


A 28 m **B** 32 m **C** 36 m **D** 40 m

2. How many kilometres in 5500 m?

A 5.5 km **B** 55 km
C 550 km **D** 0.55 km

3. The perimeter of the shape is:

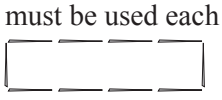


A 20 mm
B 26 mm
C 13 mm
D 23 mm

4. What is the height of Uluru if it is estimated to be 200 times higher than a 175 cm tree?

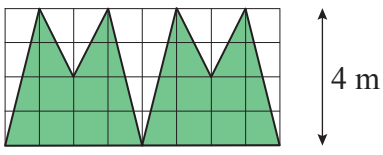
A 35 000 m **B** 350 m
C 3500 cm **D** 350 cm

5. Ten toothpicks can be used to make a rectangle in 2 ways, as shown below. How many different sized rectangles can be made using 30 toothpicks? [All toothpicks must be used each time.]



A 4 **B** 5 **C** 6 **D** 7

6. The area shaded green is closest to:

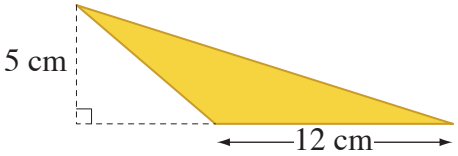


A 18 m² **B** 20 m² **C** 22 m² **D** 24 m²

7. The area of the Melbourne Airport is approximately 24 ...

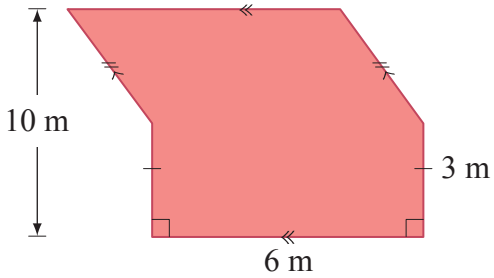
A mm² **B** m² **C** km² **D** cm²

8. The area of the triangle is:



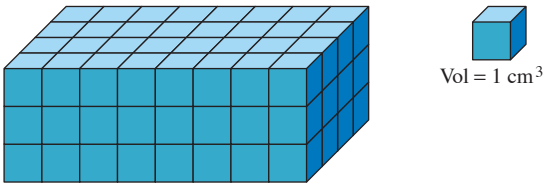
A 60 cm² **B** 50 cm²
C 40 cm² **D** 30 cm²

9. The area of the shape is:



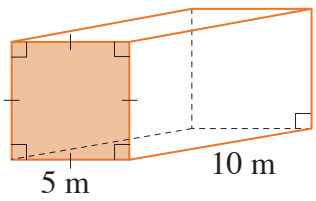
A 78 m² **B** 48 m²
C 50 m² **D** 60 m²

10. The volume of the prism is:



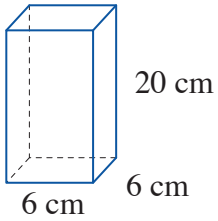
A 96 cm³ **B** 96 cm²
C 80 cm³ **D** 48 cm³

11. The volume of the square prism is:



A 250 m³ **B** 25 m³
C 300 m³ **D** 200 m³

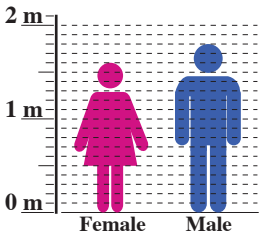
12. How much water can this container hold when it is full?



A 7.2 m³ **B** 7.2 L **C** 720 mL **D** 72 L

Short Answer

1. How much taller is an average Australian male than an average Australian female?
[Give your answer in centimetres.]



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2. Convert the units of length:

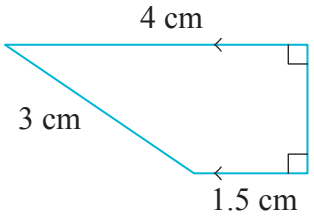
a) 31 m = ... cm

b) 10 cm = ... mm

c) 18 000 m = ... km

3. Calculate the perimeter of the shapes:

a)



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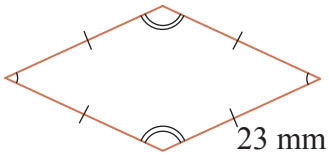
b)



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4. Arthur's Seat is the highest point on Victoria's Mornington Peninsula. How many metres above sea level is this, if it is 200 times the height of a 150 cm person?

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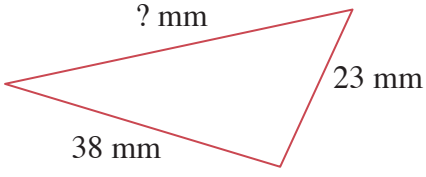
5. The perimeter of this scalene triangle is 108 mm. Find the missing side length.



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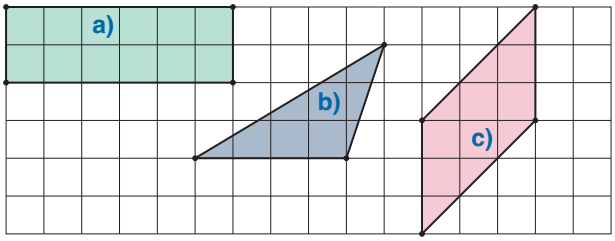
6. Calculate the area of the three shapes on the grid below:



a) ..... sq. units

b) ..... sq. units

c) ..... sq. units

7. Convert the units of area:

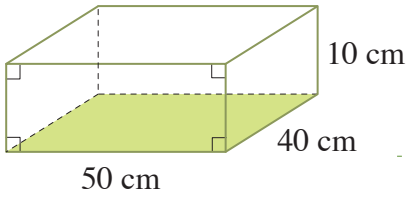
a) 4 m^2 = ... cm^2

b) 10 cm^2 = ... mm^2

c) 2 km^2 = ... m^2

8. Calculate the volume of the prisms:

a)



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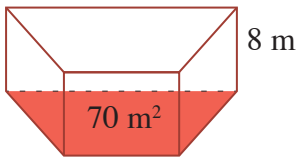
b)



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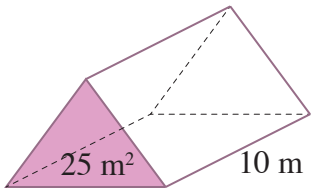
c)



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9. A swimming pool has a volume of 480 m^3 How many litres of water would you need to fill the pool?

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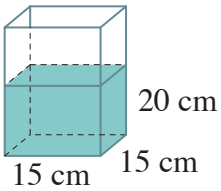
10. Find the volume, in litres, of solution in this container.



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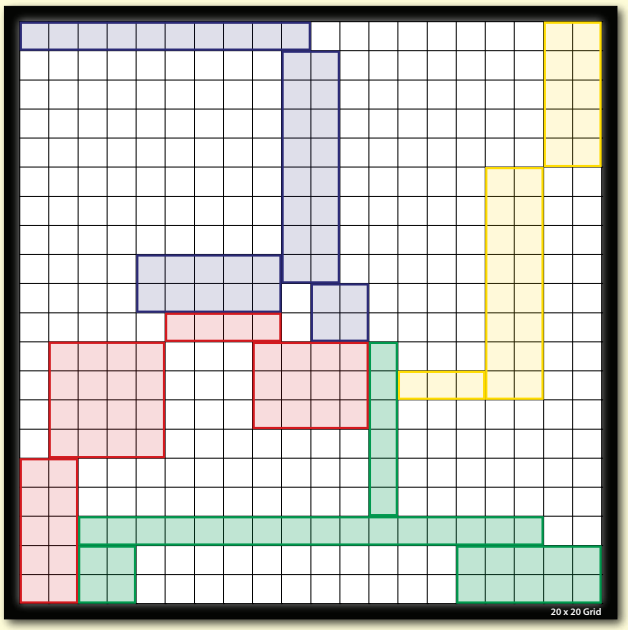
Rekt-angles

The first rectangle placed in the corner



Players: 2 or 4 **For students:** Grades 4-9
Time: 20-30 mins

Learning intent(s): Be able to work backward to find the dimensions of a rectangle after being given the area or perimeter.

EQUIPMENT

- Blank 20 x 20 grid
- A ten-sided dice
- One square tile marked with 'P' on one side and 'A' on the other
- A different coloured whiteboard marker for each player

AIM

For your rectangles to cover the greatest area/perimeter at the end of the game. Block your opponents or fence off space for yourself by choosing the rectangle that best suits your need.

STARTING THE GAME

Each player chooses a corner to start the game from. The first rectangle players place must touch their corner.

The game begins with the first player rolling both the ten-sided dice and the tile marked with 'A' (area) and 'P' (perimeter). Whatever is rolled on the dice is doubled and the letter on the tile tells players whether this number represents the area or perimeter of the rectangle they are about to create.

- Example 1) The dice lands on "8" and the tile lands on "A".
  This means all players must create a rectangle with an **area of 16** for that round.

- Example 2) The dice lands on "5" and the tile lands on "P".
  This means all players must create a rectangle with a **perimeter of 10** for that round.

Diagram 1 at the top of the page shows each player placing a rectangle with an area of 10 on the board. Not all rectangles will look the same but they must all meet the criteria given by the dice.

CRITERIA FOR PLACING RECTANGLES ON THE BOARD

To place a rectangle on the board a player must satisfy the following three criteria:

1. The rectangle must equal the area or perimeter given by the dice.

2. A player's rectangle must touch either on the edge or corner of any of their previous shapes.

3. A player's rectangle cannot overlap with any other shape that has already been placed.