Mathematics

Queensland Comparable Assessment Tasks (QCATs) 2012

Junior apprentice

Student booklet

6

Given name: . . . . . .

Family name: . . . . . .

School: . . . . . .

Queensland Government

Queensland Studies Authority

Queensland Studies Authority

Setting the scene

Memo

To: Junior apprentice

From: The Boss

Re: August challenge

You're hired!

In this month's **Junior apprentice** business challenge, you will be raising money for your favourite charity by selling healthy snack gift packs. The challenge has two parts.

Part 1: Designing a healthy snack gift pack

Healthy snacks come in two sizes (large or small), but the gift pack is only one size.

Your gift pack must:

- be a square-based prism
- hold a single layer of either large or small healthy snacks.

Part 2: Planning to raise money for charity

When planning for the charity gift pack sales, you need to:

- describe the different ways of arranging the healthy snacks
- calculate the sale price for each pack.

Good luck!

The Boss

The Boss

Queensland Studies Authority PO Box 307 Spring Hill Qld 4004
Phone: (07) 3864 0299 Fax: (07) 3221 2533 Email: office@qsa.qld.edu.au Website: www.qsa.qld.edu.au

Activity

Examine the packaging your class have brought in from home.

Your teacher will lead a discussion about packaging.

Think about these questions:

- What are the main purposes of packaging?
- What materials are used in making packaging?
- What shapes do packages come in?
- What are some examples of **one size fits all** packaging?

In this assessment, you will:

- investigate square numbers and patterns
- determine gift pack measurements
- make and explain decisions
- draw a net
- calculate amounts of material and costs.

Stop here: Wait for your teacher's directions.

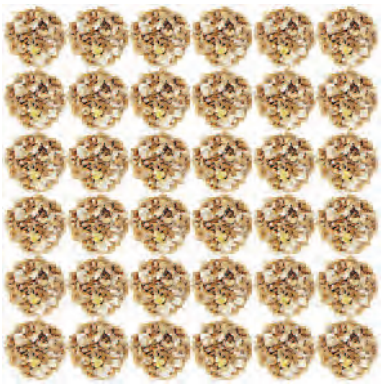
Square numbers

The design brief on page 2 states that the gift pack should:

- be a **square-based prism**
- hold a **single layer**.

In this section, you will use **square numbers** to investigate how many healthy snacks could fit in the gift packs.

1. (a) The diagram below shows a square that has 6 snacks in each row.



How many snacks are there in the square shown?

. . . . . .

(b) Draw a diagram to represent a total of 16 snacks in a square.

Use circles to represent each snack.

(c) How many snacks would be in a square that has 10 snacks in each row?

. . . . . .

Show how you worked this out.

When looking at square numbers, there are some interesting patterns that can be observed and described.

2. (a) Complete the sequences in Table 1.

Table 1: Square numbers

Number	1	2	3	4	5	6	7	8	. . .	17	18	
Square number	1	4	9						. . .			
Difference between consecutive pairs		3							. . .	. . .		

(b) Describe the pattern in **differences between consecutive pairs**.

. . . . . .

. . . . . .

(c) Use the **pattern** you identified in Question 2b to show how you could work out 19 squared (19^2).

19 squared (19^2) is . . . . . .

Show your working. . . . . .

. . . . . .

. . . . . .

(d) Identify a pattern between the **number** and **differences between consecutive pairs** rows in Table 1.

. . . . . .

. . . . . .

(e) Use the **pattern** you identified in Question 2d to check your answer for 19^2 in Question 2c.

Show your working. . . . . .

. . . . . .

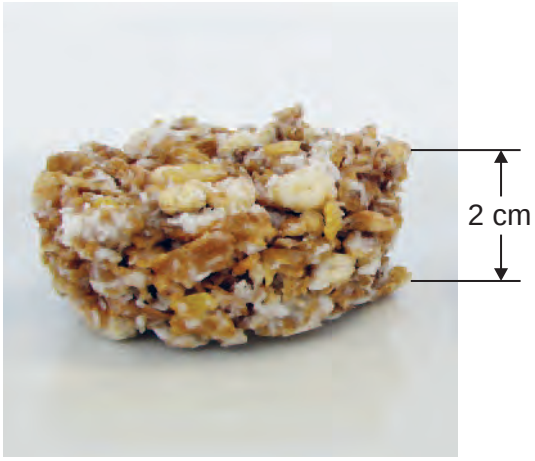
. . . . . .

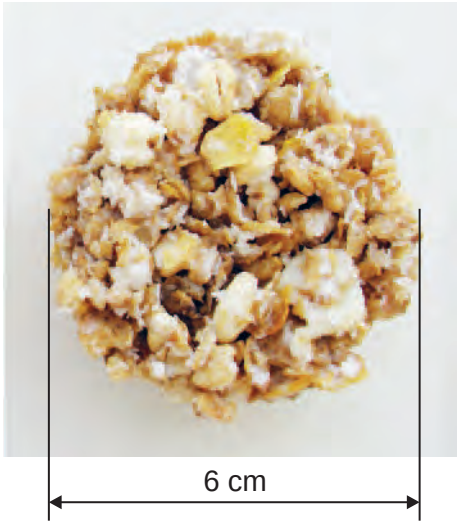
Part 1: Designing a healthy snack gift pack

Healthy snacks are made in two sizes.

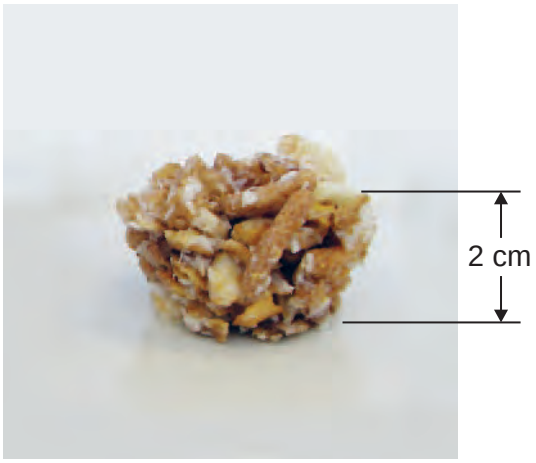
On **average**:

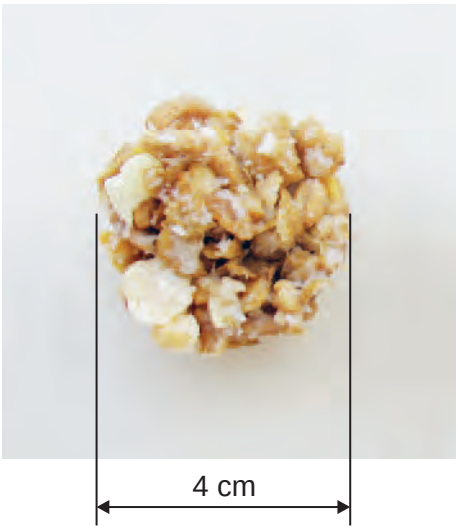
- both sizes are 2 cm in **height**
- the large size is 6 cm in **diameter**





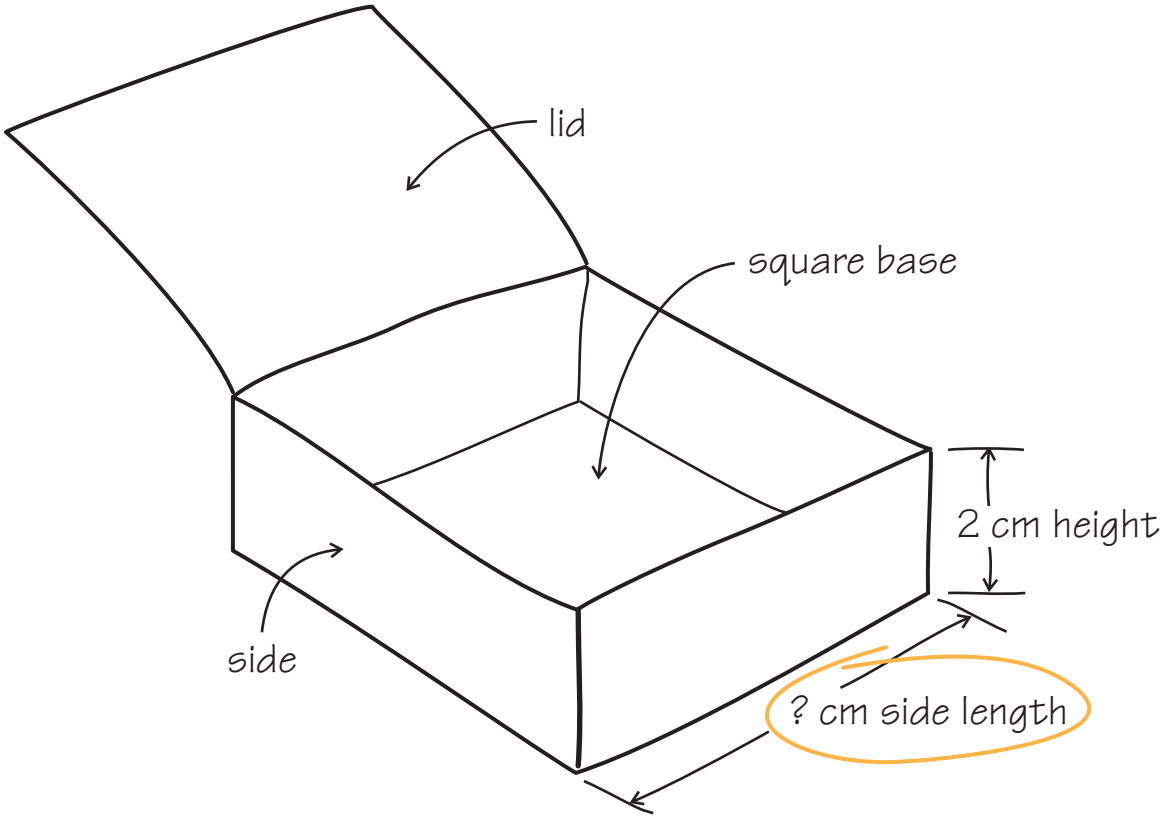
- the small size is 4 cm in **diameter**.





The design brief on page 2 states that the gift pack should be a single pack designed to hold a single layer of either large or small healthy snacks, i.e. **one size fits all**.

In this section you will determine the **side length** to use for the square base, which will best meet all the conditions of the design brief.



3. (a) Complete the sequences in Table 2.

Table 2: Possible side lengths of the gift pack

Number of snacks in each row	1	2	3	4	5	6	7	8
Large snack gift pack: side length (cm)	6	12						
Small snack gift pack: side length (cm)	4	8						

(b) Describe the rule for finding the side length using the number of large snacks in each row.

side length (cm) = ...

. . . . . .

. . . . . .

(c) Describe the rule for finding the side length using any size of snack.

side length (cm) = ...

. . . . . .

. . . . . .

(d) What are three possible side lengths (cm) that will produce a **one size fits all** gift pack?

. . . . . .

Explain why these side lengths will produce a **one size fits all** gift pack. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(e) What side length from Question 3d will result in a gift pack that uses the smallest amount of materials?

side length: . . . . . height: 2 cm

Calculate how many large snacks could fit in the gift pack above. How many small snacks could fit in the gift pack?

large snacks: . . . . . small snacks: . . . . . .

Explain how you worked this out. . . . . .

. . . . . .

. . . . . .

. . . . . .

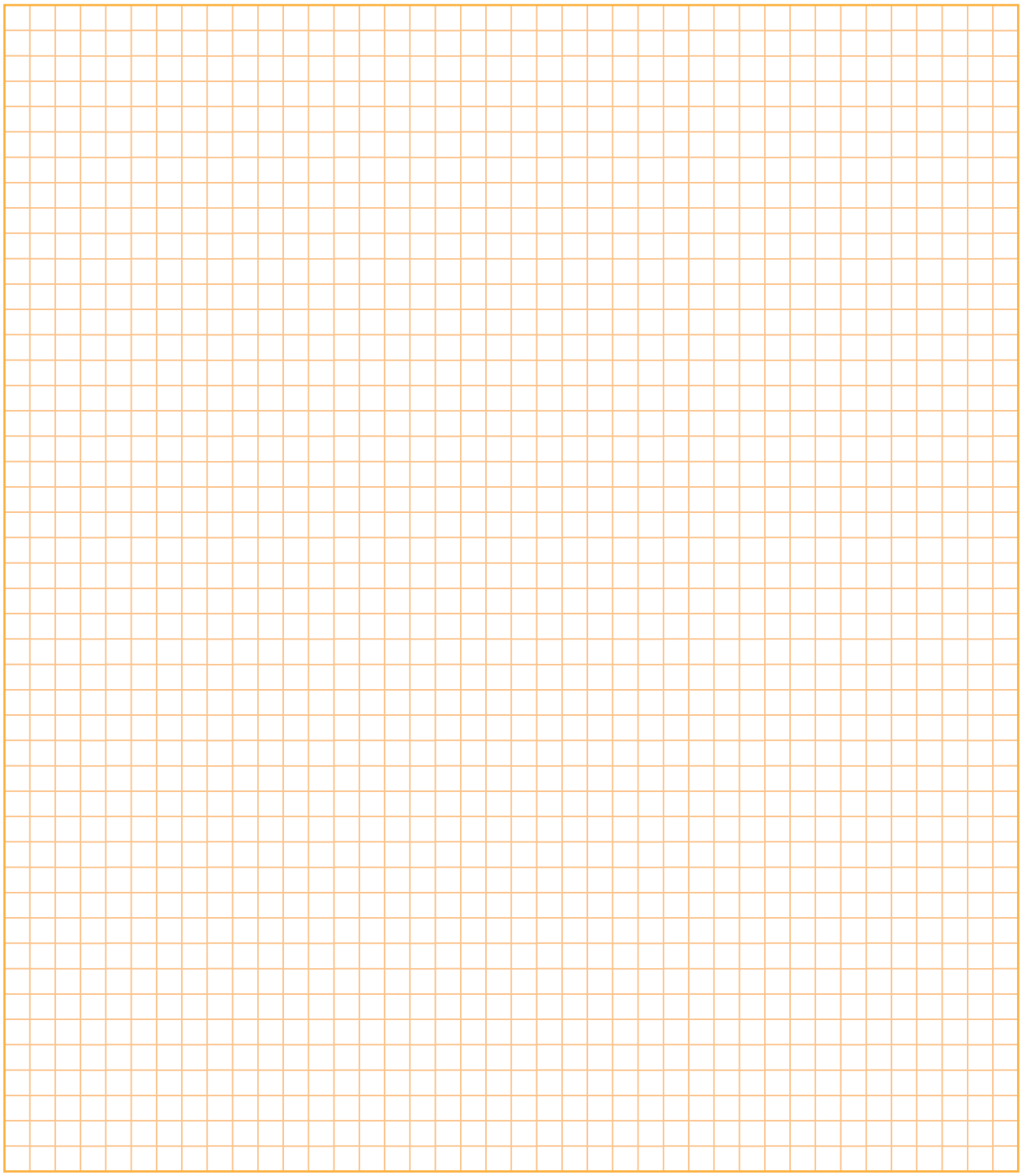
. . . . . .

4. Draw the **net** of the gift pack (square-based prism) in Question 3e.

Remember:

- that the drawing must be to scale
- to label the base, sides and lid
- to label with measurements
- that nets do not have tabs.

1 square = 1 cm



Stop here: Wait for your teacher's directions.

Part 2: Planning to raise money for charity

The Memo states that the gift pack should:

- be a square-based prism
- hold a single layer of either large or small healthy snacks, i.e. **one size fits all**.

Your favourite charity has asked you to raise money for them, by selling 50 gift packs. Each gift pack is to contain a **dozen** healthy snacks.

5. Why can't the charity gift packs follow the original design brief?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

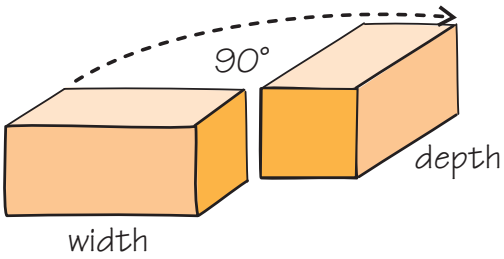
Stop here: Wait for your teacher's directions.

Arranging the snacks

One way of arranging a dozen snacks is described in Table 3.

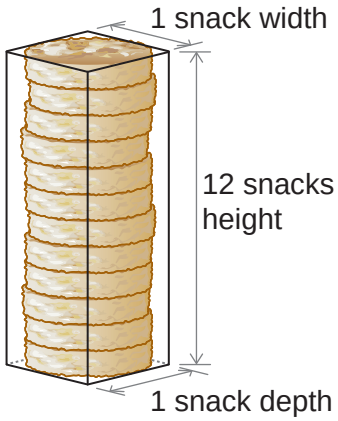
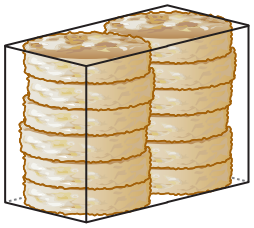
6. Describe the nine other ways of arranging a dozen snacks in Table 3 below.

Check your work.



Remember that two prisms will be exactly the same if you can turn one 90 degrees and match it to the other.

Table 3: Possible arrangements of a dozen snacks

Example: height: 12 snacks depth: 1 snack width: 1 snack  	height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks 
height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks	height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks

height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks	height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks
height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks	height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks
height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks	height: . . . . . snacks depth: . . . . . snacks width: . . . . . snacks

Calculating the sale price

Remember that the request from the charity is for you to sell 50 gift packs. Each gift pack is to contain a dozen healthy snacks.

7. Calculate a **sale price** for each charity gift pack.

Your sale price needs to:

- cover all the costs of making the gift packs
- raise between $100 and $150 for your favourite charity.

Table 4 shows the costs for the materials that will be used in making the charity gift packs.

Table 4: Gift pack costs

Card	$12.95 for 5 sheets 1 sheet will make one gift pack
Pre-printed packaging labels	$6.45 for 10 labels
Curling ribbon	$2.50 for 25 metres allow 1 metre for each gift pack
Healthy snack	$0.30 for each snack

Working: . . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Sale price per pack: . . . . . .

Guide to making judgments — Year 6 Mathematics

Student name . . . . . .

Focus: Uses reasoning and applies understanding of special numbers and sequences to solve problems about gift packs.

Understanding	Skills		
Understanding	**Problem solving, Reasoning**		
Describes and applies: • properties of special numbers • patterns and rules for sequences. Questions 1, 2, 3a–c	Explains: • choices made about the prism • strategies used to find the number of snacks in the box • conclusions reached about why a dozen snacks cannot meet the design brief. Represents square-based prism as a net. Questions 3d–e, 4, 5	Applies problem-solving strategies to: • investigate simple prisms as nets • generate arrangements for charity gift boxes • calculate cost of the charity gift pack. Questions 3d–e, 6, 7	Communicates reasoning, solutions and calculations, using mathematical language, conventions and symbols. Questions 1c, 2b–e, 3b–e, 5, 7	
◀ Accurately interprets patterns to find and check the square of 19 (Q2c, e).	◀ Gives accurate and reasoned explanations that consider properties of special numbers and design brief conditions (Q3 d–e, 5).	◀ Systematically applies problem-solving strategies to: • calculate the cost per gift pack, which will result in the profit indicated (Q7) • generate all unique arrangements of a dozen snacks (Q6).	◀ Clearly describes and reasons using appropriate mathematical language (Q2b, d, 3b–e, 5). Clearly and consistently annotates worked solutions using appropriate mathematical conventions and symbols to show meaning (Q1c, 2c, e, 7).	A
◀ Continues sequence beyond given values in Table 1 using the pattern identified (Q2a). Appropriately applies patterns to find and check the square of 19 (Q2c, e). Accurately describes mathematical rules for finding side length (Q3b–c).	◀ Represents the square-based prism as a net and is consistent with side length chosen (Q4).	◀ Selects side lengths beyond Table 2 that meet conditions of the design brief (Q3d). Calculates the number of snacks in the gift pack (Q3e). Generates most arrangements of a dozen snacks, with some duplication (Q6 a).	◀ Accurately labels net using appropriate spatial conventions (Q4).	B
◀ Creates a sequence of square numbers and their differences for numbers up to 18 in Table 1 (Q2a). Identifies: • a second pattern in Table 1 (Q2d) • general rules for finding side length (Q3b–c).	◀ Gives appropriate mathematical descriptions (Q3d–e, 5).	◀ Selects side lengths from Table 2 that meet conditions of the design brief (Q3d).	◀ Describes and reasons using mathematical language (Q2b, d, 3b–e, 5). Works solutions using mathematical conventions and symbols (Q1c, 2c, e, 7).	C
◀ Creates a sequence of: • square numbers and their differences for numbers up to 8 in Table 1 (Q2a) • possible dimensions in Table 2 (Q3a). Identifies: • a pattern in differences (Q2b) • general patterns in side length (Q3b–c).	◀ Represents aspects of the square-based prism as a net (Q4). ◀ Makes a statement related to the problem (Q3d–e, 5).	◀ Selects the number of snacks in each row from Table 2 for calculation of the number of snacks in the box (Q3e). Uses operations to calculate the costs of individual materials (Q7). ◀ Selects side length from Table 2 that meets conditions of the design brief (Q3d–e). Generates some arrangements of a dozen snacks (Q6).	◀ Works solutions using aspects of mathematical conventions and symbols (Q1c, 2c, e, 7). Labels net using aspects of spatial conventions (Q4).	D
◀ States square numbers in obvious situations (Q1).		◀ Uses teacher provided problem solving strategies and operations.	◀ Communicates using everyday language (Q2b, d, 3b–e, 5).	E

Feedback: . . . . . .