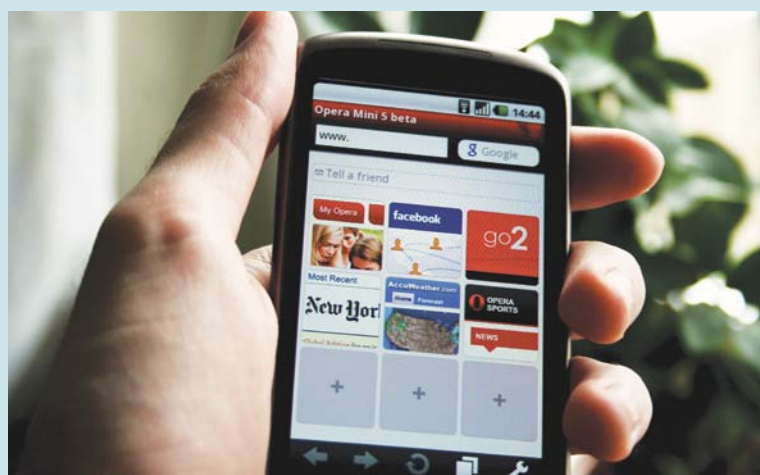# Smartphones, smart thinking

Student booklet

9

Mathematics

Queensland Comparable
Assessment Tasks
(QCATs) 2011

Given name: ....

Family name: ....

School: ....

Setting the scene: Group discussion

- 76% of 12- to 14-year-olds own a mobile phone (Australian Bureau of Statistics, 2009).
- Mobile phones are a major source of youth debt (Office of Fair Trading, 2003).
- Texting — why is it many teens' preferred method of communicating?
- Smartphones — what are they, and what can they do?
- Can I own a mobile without getting into debt?
- Contract, prepaid, cap, postpaid — what do they mean, and which is best for me?
- Mobile plan terms — look at the **e-tel brochure**.

Disorders in the communication age? (Boost mobile, 2010)

These terms were coined by a mobile phone company.

Textiety: A feeling of anxiety caused when not receiving or sending any text messages.

Textaphrenia: Thinking you've heard or felt a text message arrive when it hasn't.

Binge texting: Sending massive numbers of texts to build self-esteem among peers.

Post-traumatic text disorder: Injuries related to texting, such as walking into objects by not paying attention to your surroundings.

Textaholic: One who sends more than 50 texts a day.

In this assessment, you will use mathematical reasoning to:

- analyse and infer from data about mobile phone ownership
- analyse and interpret smartphone features
- reflect on your understandings to give financial advice.

Show your working

- Your teacher is looking for evidence of mathematical thinking and reasoning, not only correct answers.
- When using a calculator, show enough working so that your teacher can see the method you used.
- If you cannot complete a question, show what you have been able to do.
- Credit will be given if an incorrect answer is used correctly in a later question.

Show all working

When you see a space like this, show all your working.

Trends in mobile phone ownership

Table 1: Mobile phone ownership in Australia (2006 to 2010)

End of year	Total number of mobile phones (millions)	Internet-capable mobile phones (millions)
2006	19.3	1.6
2007	20.8	4.6
2008	21.8	8.6
2009	23.4	12.3
2010	26.1	16.8

Source of data: <www.acma.gov.au>

1. Complete Graph 1 to show all the data from Table 1:

   - include a title
   - plot the data for internet-capable mobile phones
   - complete the key.

Graph 1: ....
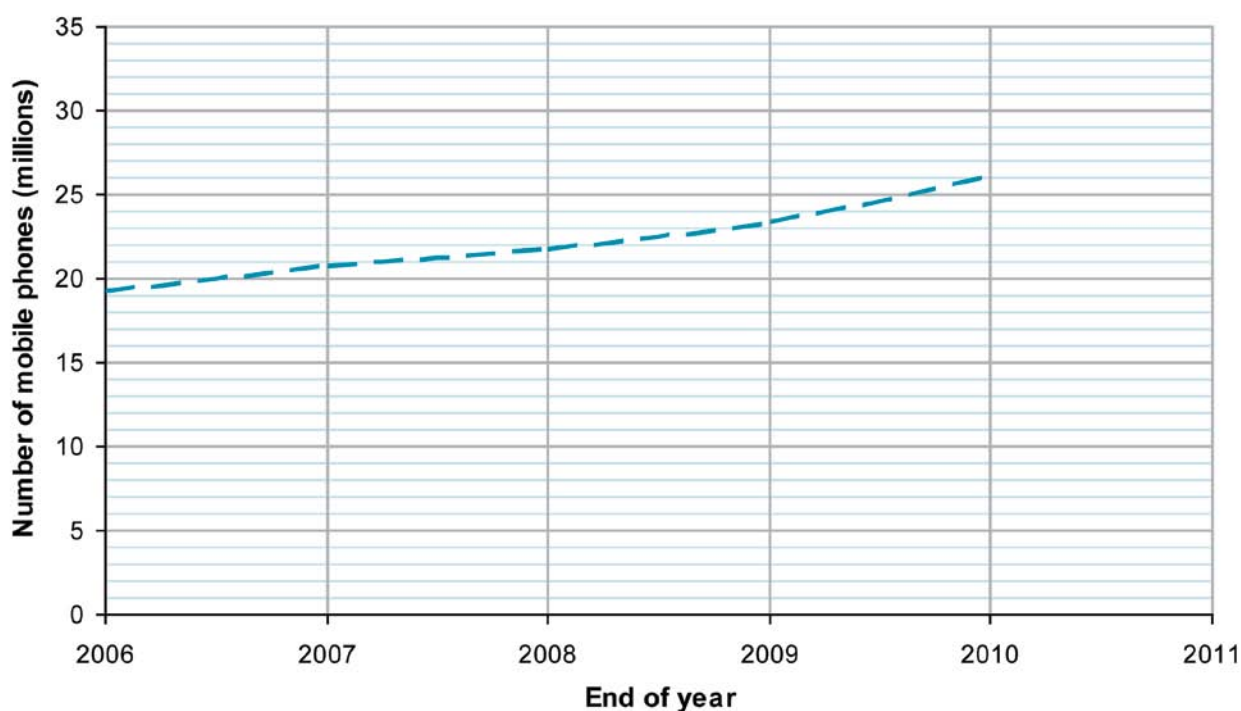
Key	– – –	Total number of mobile phones
		....

2.   **a)**   **Describe the trend in total mobile phone ownership in Australia since 2006.**
Use Graph 1 to help you.

....

....

....

....

b)   **Describe how rapidly ownership of internet-capable mobile phones has changed compared to total mobile phone ownership.** Refer to Graph 1 in your answer.

....

....

....

....

3.   **During which year did internet-capable phones make up half of all mobiles?**
Justify your answer.

Show all working

....

4.   **Use Graph 1 to make the following predictions.**

Total number of mobile phones at the end of 2011:   ....

Total number of internet-capable phones at the end of 2011: ....

Stop here: Wait for your teacher's directions.

Smartphones adjust for different time zones

Smartphones can automatically adjust to local time when the phone moves into a different time zone. They can even adjust for daylight saving.

Key
- Australian Eastern Standard Time (AEST)
- AEST – 0.5 hours
- AEST – 2.0 hours
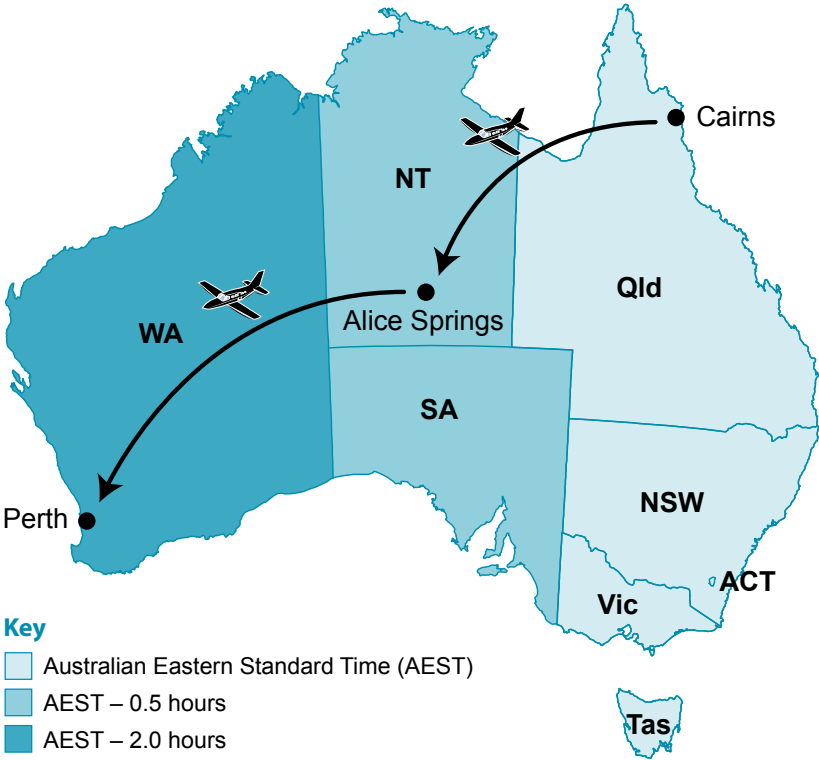
Table 2: Flight durations

From	To	Duration (hours:minutes)
Cairns	Alice Springs	1:45
Alice Springs	Perth	3:05

The clock in Nadia's smartphone automatically updates when she moves to a new time zone.

5. a) **If Nadia's plane leaves Cairns at 8:14 am, what time will her smartphone show when she arrives in Alice Springs?**

Show all working

Time shown on phone: ....

Nadia stops for 45 minutes in Alice Springs, then flies on to Perth.

b) What time will Nadia's smartphone show when she arrives in Perth?

Show all working

Time shown on phone: ....

Nadia's friend Lillian lives in Victoria. Nadia promised to send Lillian a text from Perth before Lillian goes to bed.

6.   What is the latest time that Nadia can text Lillian?

- Lillian goes to bed at 10:00 pm.

- It is summer and Victoria uses Australian Eastern Daylight Time (AEDT).

- AEDT = Australian Eastern Standard Time (AEST) + 1 hour

- Queensland, Western Australian and Northern Territory do not use Daylight Saving Time.

- Allow 5 minutes for the text to arrive.

Show all working

Latest Nadia can text: ....

Stop here: Wait for your teacher's directions.

Storing, sending and displaying photos

- Digital photos are made up of tiny dots called pixels.

- Each pixel contains 3 bytes of data.

- A digital photo is stored as a file containing the data in every pixel.

Remember:

kilo = 1 thousand

mega = 1 million

7.   **a)** **What is the file size of a 5-megapixel photo?**
Give your answer in megabytes (MB).

Show all working

File size: .... **MB**

Photo files are usually compressed to reduce the total file size.

b) **What is the new file size if the photo file in Question 7a is compressed to 12% of its original size?**

Show all working

File size: .... **MB**

When Nadia sends Lillian a photo in a multimedia message (MMS), her phone compresses the 1.84 MB file to 300 kB.

8.   **What percentage is the compressed file (300 kB) of the original file (1.84 MB)?**

Show all working

.... **%**

More pixels per square centimetre make a clearer picture

A pixelated photo

Less than
10 000 pixels per
square centimetre

1 cm

1 cm

1 cm

1 cm
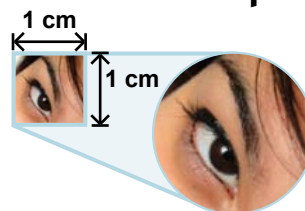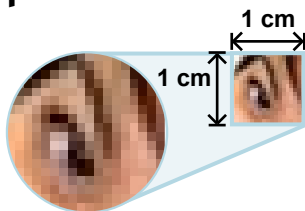
A clear photo

10 000 pixels
or more per
square centimetre

- The smartphone shown in **A** and **B** below has a screen size of 8 cm x 5.3 cm.
- The photo displayed is made up of 250 000 pixels.

A

5.3 cm

8 cm

B
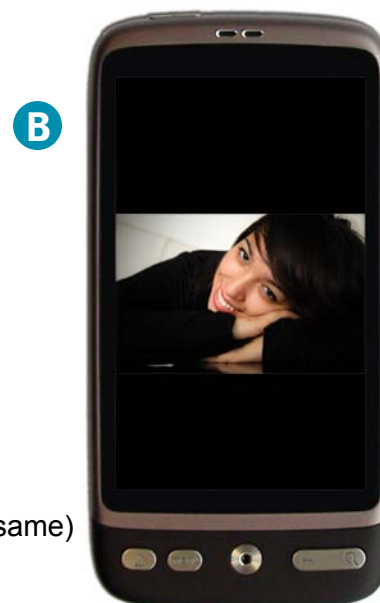
When the phone is rotated from **A** to **B**:

- the photo stays the same shape (the ratio of the sides stays the same)
- the number of pixels does not change.

---

9. **Use calculations to explain why the photo in A is pixelated and in B is clear.**

A Show all working	**B** Show all working

Using a phone for social networking and email

Social networking on a mobile phone

- Aaron has a data allowance of 200 MB per month (assume 1 month = 30 days).

- Accessing a social networking site such as Facebook uses about 10 MB of data per hour.

- Assume Aaron does not download or upload any other data.

10.   How many minutes each day, on average, can Aaron spend on Facebook without going over his data limit? Give your answer to the nearest minute.

Show all working

....

Text or email — which is better value?

- Aaron can send data (including email) from his phone at a cost of 50 cents per MB.

- It costs Aaron 28 cents to send a text message.

11.   How many 10 kB emails can Aaron send for the cost of one text message?

Show all working

....

Extra working space

Stop here: Wait for your teacher's directions.

Joe's phone use on a prepaid plan

Joe uses e-tel's **$29 prepaid** plan, and his typical weekly phone use is shown in Table 3.

Look at your **e-tel brochure** for details of Joe's plan.

12. **Complete Table 3 below to show:**

- cost of calls and messages
- total data that Joe uses in a typical week.

Table 3: Joe's typical weekly phone use

Weekly calls and messages		Cost ($)	Weekly data use		Data (MB)
8	2-minute voice calls	....	3 hrs	Facebook	....
110	text messages	....	40	sent emails	0.4
4	multimedia messages	2.00	25	received emails	....
			1	song download	5.0
Total cost of calls and messages		**$50.00**	**Total data used**		....

Working space for Question 12 (if required)

13. **a)** Show that the included value ($) in a **$29 prepaid** recharge lasts Joe 3 weeks.

....

b) How long could the included data (MB) in Joe's **$29 prepaid** recharge last?

....

c) How often will Joe need to buy a **$29 prepaid** recharge so that he can continue to use his phone as shown in Table 3?

....

Can Joe afford a new smartphone?

- Joe would like to change from the **$29 prepaid** to the **$29 contract** plan so that he can get a new smartphone.

- He cannot afford to spend much more each month than he is now spending on his prepaid plan.

- Look at the **e-tel brochure** for plan details.

14. **Advise Joe whether he could change to the $29 contract plan without spending much more than he is now spending on his prepaid plan.**

In your answer, use mathematical reasoning to:

☐   work out how much Joe is spending per month (30 days) on his $29 prepaid plan, using your answer in Question 13c

☐   find out how much Joe would spend each month if he changed to the $29 contract plan, based on his typical phone usage as shown in Table 3 (remember that in a contract plan, you pay extra when you exceed included data or value)

☐   work out how Joe could make better use of his included data so that he does not exceed the included value in the $29 contract plan

☐   provide advice to Joe based on your calculations and relevant information in the task.

Show all working

Show all working

I would advise Joe to **change** / **not change** to the $29 contract plan because: ....
(circle one)

....

....

....

....

....

....

....

....

Guide to making judgments — Year 9 Mathematics

Name ....

Focus: Apply mathematical reasoning to analyse mobile phone trends, features, uses and payment plans, and to justify financial advice.

	Knowledge and understanding	Thinking and reasoning / Reflecting	Communicating
	Displays and analyses data to make inferences about trends in mobile phone use. Performs calculations involving time zones, digital data and percentage. Questions 1–5, 7, 8	Solves problems involving time, area, ratio, rate, proportion and units of measurement. Calculates mobile phone use costs and chooses strategies to provide financially sound advice. Reflects on learning to justify reasoning. Questions 6, 9–14	Uses mathematical language and representations when communicating thinking and justifying reasoning. Questions 1–14
A	Provides clear, justified analysis of trends. Consistently successful with calculations involving time zones, digital data and percentage.	Correctly applies understandings to explain why a photo is clear. Provides detailed, fully justified financial advice, based on a consideration of all relevant information.	Clearly and logically communicates procedures, reasoning and justification using mathematical representations and language, including units and appropriate rounding.
B		Correctly converts between time zones involving daylight saving, explains why a photo is pixelated and determines the number of emails sent for the cost of a text message.	
C	Correctly plots data, includes an appropriate title and key and makes valid predictions. Demonstrates some success in analysing trends in mobile phone ownership and moderate success in calculations involving digital data and percentage. Makes significant progress with time zone calculations.	Makes significant progress in most of the following problems, leading to some solutions: explains why a photo is pixelated, determines Aaron's average daily social networking allowance and Joe's prepaid recharge period. Provides financial advice based on a consideration of some relevant information.	Shows working and units in most calculations. Makes some use of mathematical language in explanations.
D		Makes progress in some of the following: explains why a photo is pixelated, determines Aaron's average daily social networking allowance and Joe's prepaid recharge period, provides financial advice.	
E	Demonstrates some success in displaying or analysing data, or in calculations involving digital data and percentage.		Shows some working.

Feedback ....