

Making the most of music

Student booklet



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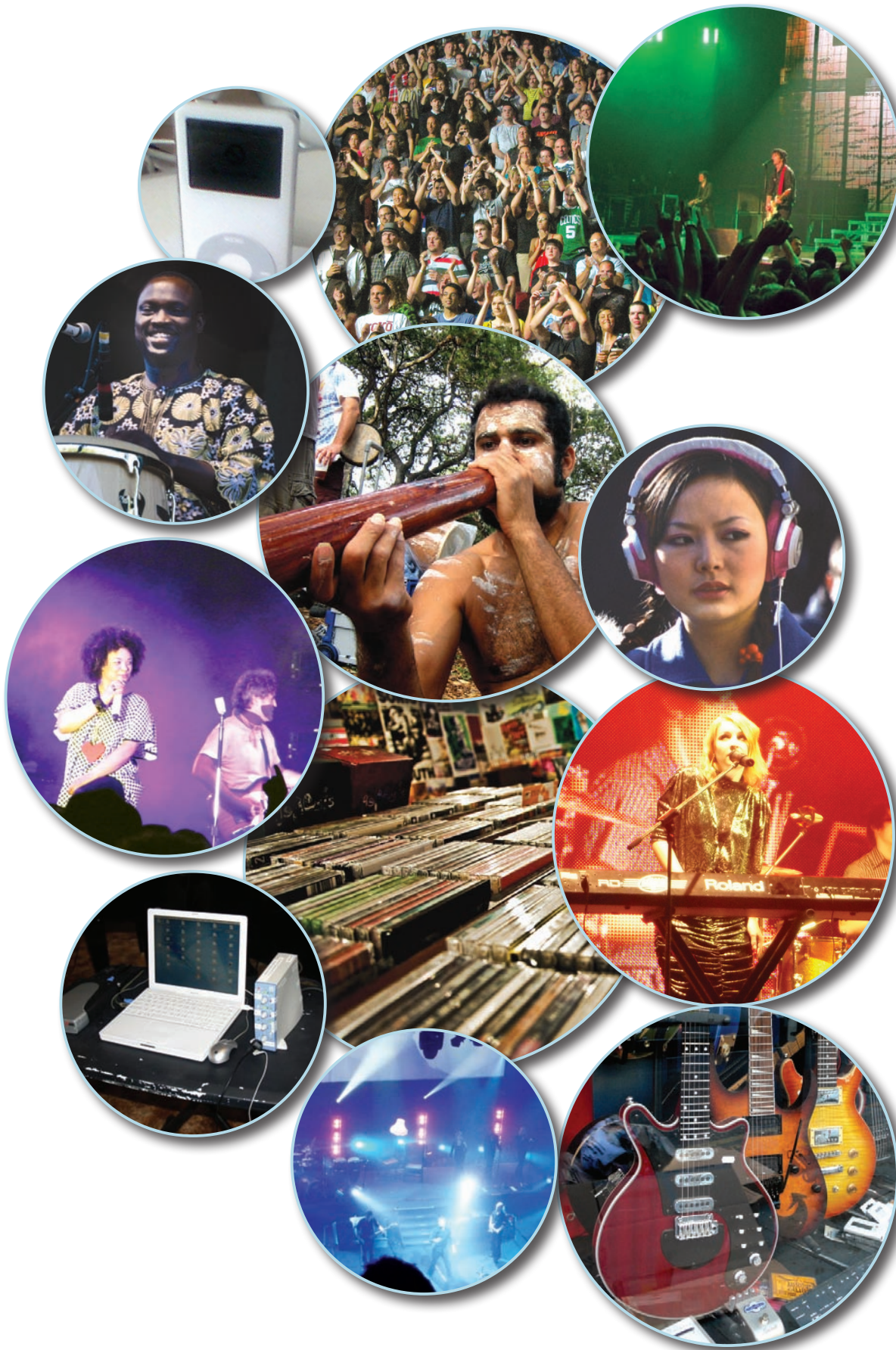
Mathematics

Queensland Comparable
Assessment Tasks (QCATs)
2010

Given name:

Family name:

School:

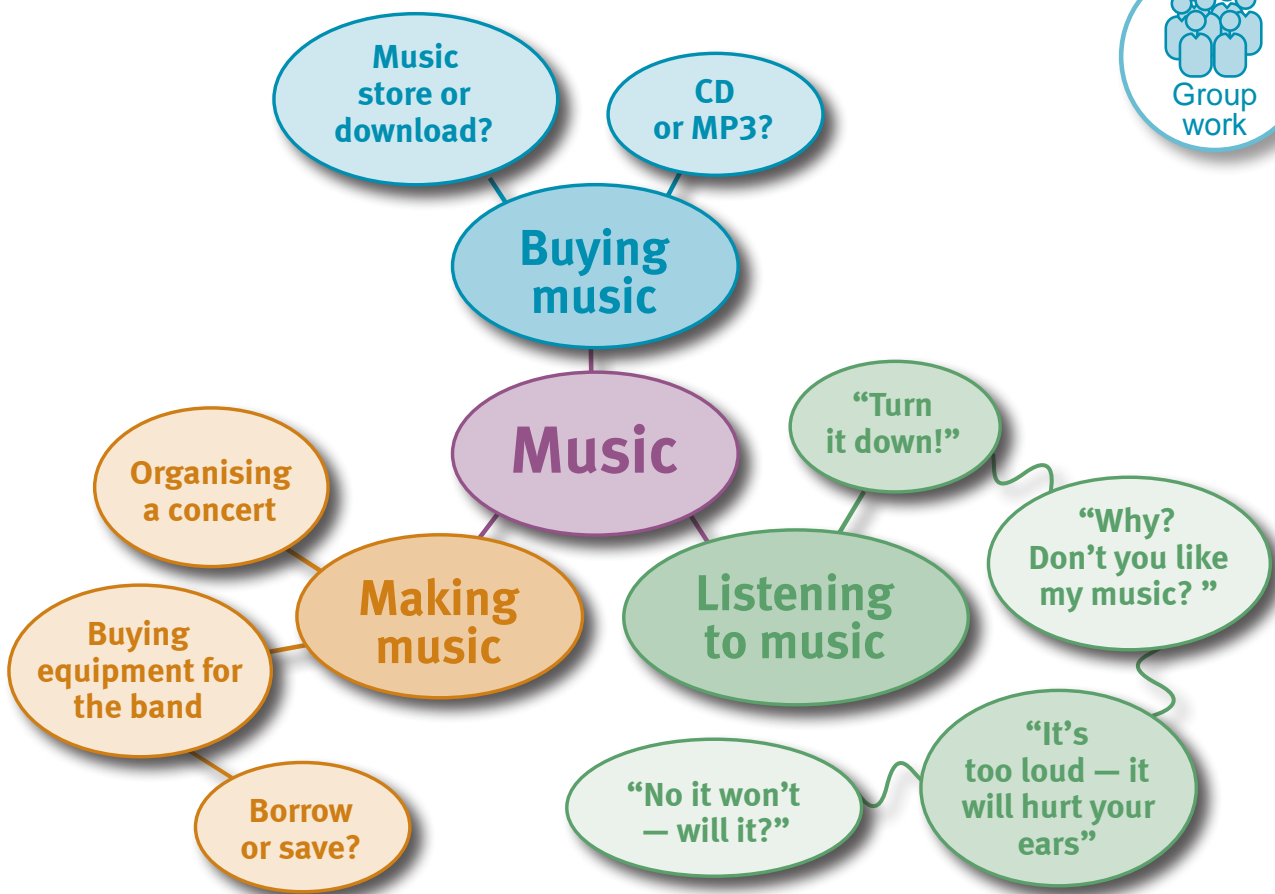


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iPod: jhderojas' photostream, "iPod Nano 2Gb Refurbished", <<http://www.flickr.com/photos/jhderojas/462930688/>>; Crowd: Anirudh Koul's photostream, "Green Day Concert Stage (Montreal) - Green Day is Ever Green", <<http://www.flickr.com/photos/anirudhkoul/3735171010/>>; African drummer: Sona Watson's photostream, "Celebrate Brooklyn, NY, Brooklyn, African Music Festival, Summer 2009, (94 of 123)", <<http://www.flickr.com/photos/mseckington/3486183880/>>; Didgeridoo player: Bruce Turner's photostream, "didgeridoo player", <<http://www.flickr.com/photos/whiskeytango/3555497090/>>; Girl with headphones: mseckington's photostream, "The Sound of Pink", <<http://www.flickr.com/photos/mseckington/3486183880/>>; Sneaky sound system: Michael Spencer's photostream, "Sneaky Sound System @ Rollercoaster 08", <<http://www.flickr.com/photos/michael-spencer/3144195344/>>; Compact discs: MaxDug's photostream, "022109_0107", <<http://www.flickr.com/photos/maxdug/3302761494/>>; Kate Miller-Helke: Kate Miller-Helke's photostream, "Kate Miller - Helke @ One Movement Music Festival", <<http://www.flickr.com/photos/michael-spencer/4022320433/>>; Computer: paparutzi's photostream, "mark's recording equipment", <<http://www.flickr.com/photos/paparutzi/195011173/>>; Concert: simononly's photostream, "Australian Pink Floyd", <<http://www.flickr.com/photos/simononly/3444606755/>>; Guitars: psd's photostream, "Brian May's Signature Red Guitar", <<http://www.flickr.com/photos/psd/2262072915/>>.

Setting the scene: Group discussion



In this assessment, you will use mathematical reasoning to:

- determine costs and times when buying and downloading music
- compare different payment options when buying recording equipment
- analyse data to determine safe loudness levels when listening to music
- reflect on your understandings to plan a charity concert.

Show all working

It is important to show all your working so that your teacher can see what you know, understand and can do, even if you make a mistake in your calculations. Credit will be given if an incorrect answer is used correctly in a later question. Your teacher is looking for mathematical thinking and reasoning, not only correct answers.



Show all working

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

Buying music

Use the CD cover below to answer Questions 1 and 2.



Photographic image: Mzelle Biscotte's photostream, "damier...", <http://www.flickr.com/photos/biscotte/2863680764/>, a Creative Commons Attribution 2.0 Generic licensed photo, accessed 27 Dec, 2009.

Playing time of each song (minutes:seconds)

- What is the cost of downloading all 14 songs at \$1.19 per track?



Show all working

Cost =

- How much do you save by downloading rather than buying the CD for \$19.95?




Show all working

Amount saved =

Use the playlist on the right to answer Questions 3 to 5.

Playlist	Playing time (minutes:seconds)
Sleeping in	4:40
She said ... like ...	4:20
Whatever!	2:30


3. What is the total playing time of the playlist above (in minutes and seconds)?

 Show all working

Playing time =

4. How many megabytes (MB) of data are contained in the playlist above?


Assume one minute of music = 1.2 megabytes (MB) of data

 Show all working

Amount of data =

5. How long would it take to download the playlist at a speed of 50 kilobytes per second (kB/sec)? Give your answer to the nearest minute.

Assume 1 MB = 1000 kB

 Show all working

Time to download =



Stop here: Wait for your teacher's directions


Buying recording equipment

To record their next CD, the band **In My Shoes** need to buy the equipment shown in the online shopping trolley below.


6. Complete the table below to show the cost of the equipment.

 Online Music Store			Shopping trolley	
Product	Price	Quantity	Cost	
 PA system	\$750.00	1	
 Computer	\$1995.00	1	
 Mixer	\$720.00	1	
 Microphone	\$315.00	2	
 Pack of 50 blank CDs	\$10.50	10	
			Total price	
			

The band see the following advertisement, and decide to borrow money to buy the equipment this month.


 **Online Music Store**
10% discount — this month only
 Don't have the cash? Borrow from us!
 \$200 deposit and easy weekly repayments.

7. a) What will be the total price if **In My Shoes** buy the equipment this month?

 Show all working

Discounted price =

- b) If the band has \$200 for a deposit, how much will they need to borrow to buy the equipment at the discounted price?

 Show all working

Amount borrowed =

- c) What are the total repayments if the band make weekly payments of \$163 per week for 26 weeks (6 months)?



Show all working

Total amount paid =

- d) How much interest (in \$) will **In My Shoes** pay?



Show all working

Amount of interest paid =

8. Calculate the annual interest rate (%), using simple interest.



Show all working

Simple interest formula:

Annual interest rate =

9. Do you think **In My Shoes** should have saved up and paid in cash instead of borrowing money? Why? (Refer to relevant answers in Questions 6 to 8.)

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Stop here: Wait for your teacher's directions

Enjoying music — how loud is too loud?

Loud sounds can cause permanent hearing damage. The louder a sound, the more quickly it can do damage. Table 1 show examples of the loudness of common sounds in decibels (dB).

Table 1: Loudness of common sounds

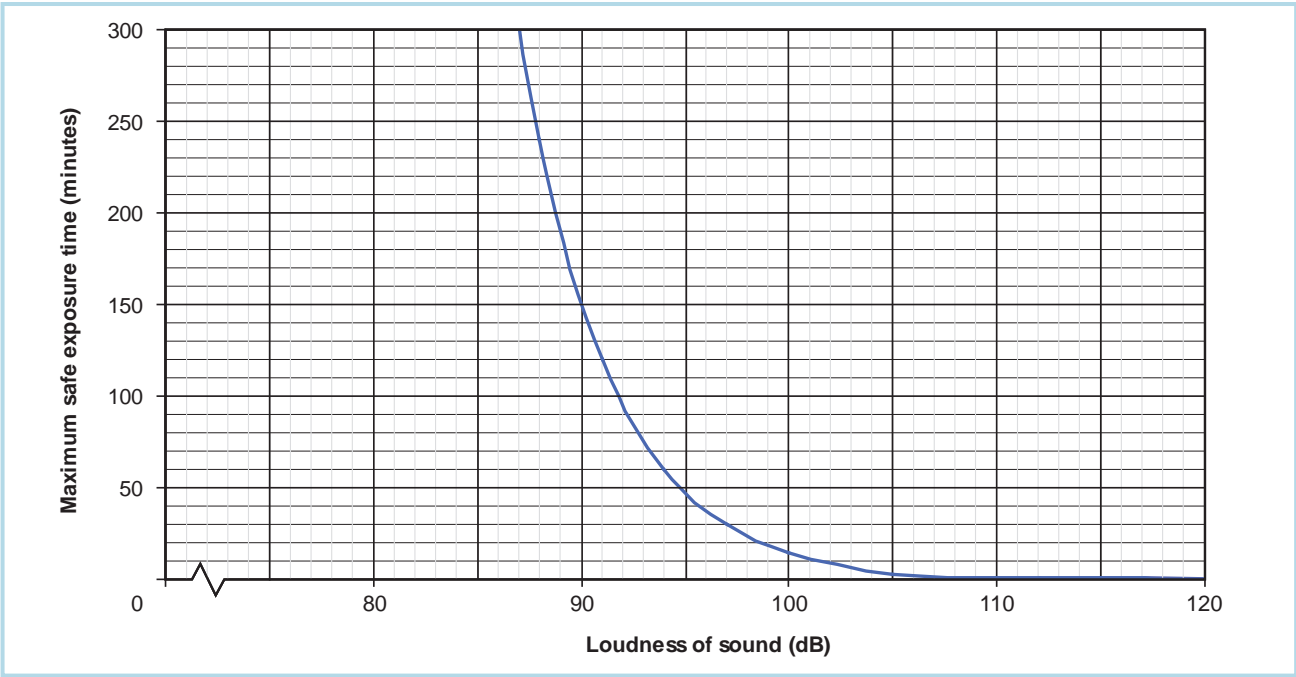
Loudness (dB)	Example of sound
0	Can just be heard
10	
20	Rustling leaves
30	
40	A whisper
50	
60	A normal conversation
70	A noisy classroom
80	Beside a busy street
90	Lawn mower, 1 metre away
100	
110	Chainsaw, 1 metre away
120	
130	Racing car, 1 metre away



Images (top to bottom) are Creative Commons: Attribution 2.0 Generic licensed photos <<http://creativecommons.org/licenses/by/2.0/>> accessed 27 Dec. 2009. **Leaves:** russell.bride's photostream, "Autumn Leaves", <<http://www.flickr.com/photos/russell.bride/1532828160/>>. **Group of kids:** Gilgongo's photostream, <<http://www.flickr.com/photos/gilgongo/2369879410/>>. **Busy street:** emmettanderson's photostream, "Melbourne Busy Fitzroy", <<http://www.flickr.com/photos/emmettanderson/3527264871/>>. **Lawn mower:** ansik's photostream, "old faithful", <<http://www.flickr.com/photos/ansik/154970777/>>. **Racing car:** oseille's photostream, "formula 1 (titl shift)", <<http://www.flickr.com/photos/oseillo/2113201880/>>.

Graph 1 shows the recommended safe time limits for listening to loud sounds.

Graph 1: Time limits for safe exposure to loud sounds



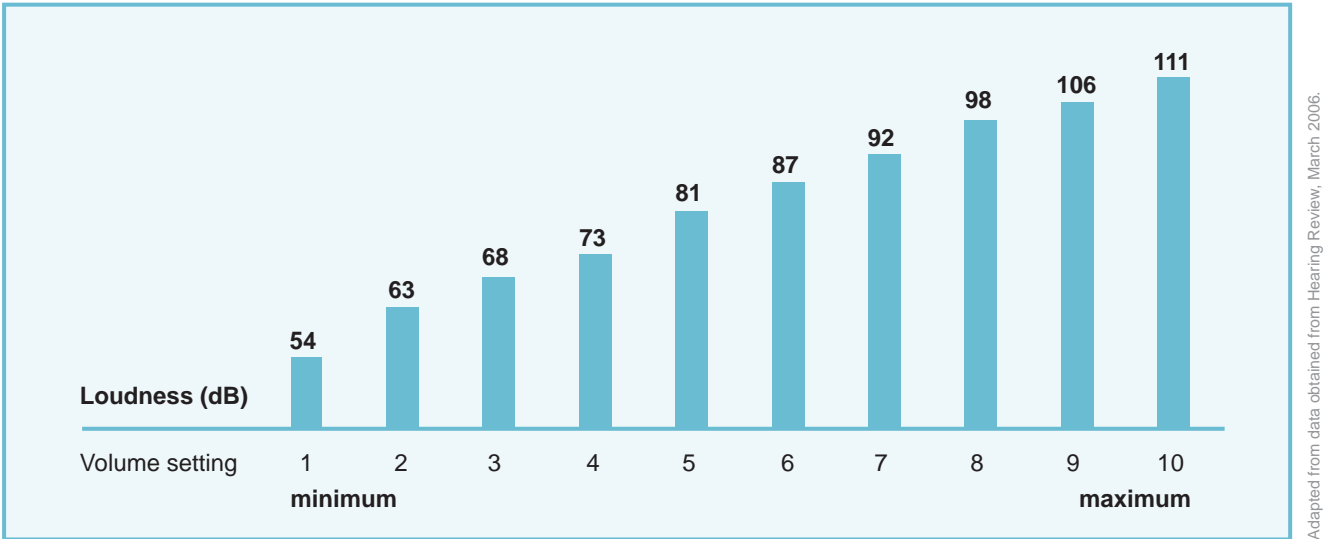
Source of data: National centre for research resources, USA.

10. Use Graph 1 to answer the following:

- a) For how long could you safely listen to a sound at 90 dB?
- b) What is the maximum safe loudness for four hours' listening?

Table 2 shows loudness measurements taken from an MP3 player's earphones as the volume is increased.

Table 2: Loudness of music in MP3 player earphones



11. Use Graph 1 and Table 2 to answer the following:

- a) What is the maximum safe volume setting (1 to 10) for listening to the MP3 player for one hour?

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Explain:

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- b) For how long can you safely listen to the MP3 player at the maximum volume?

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Explain:

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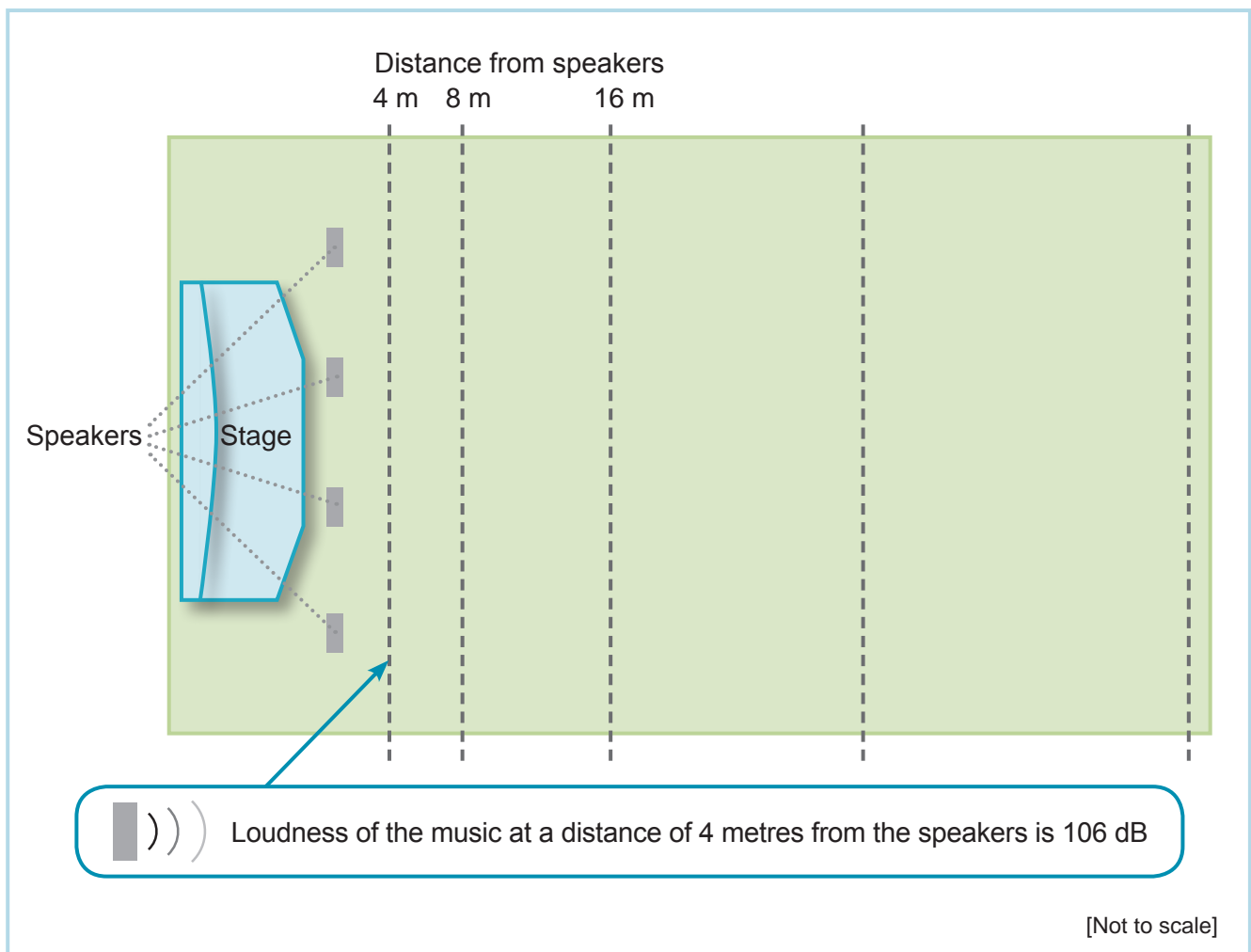
How loud?

At an outdoor concert, the loudness of the music decreases as you move further away from the speakers.

Wherever you are sitting, if you move to a seat twice as far away from the speakers, the loudness drops by about 6 decibels (dB).

i.e. When moving from 3 m to 6 m, or from 6 m to 12 m, the loudness drops by 6 dB.

Diagram 1: Loudness of music at an In My Shoes concert



12. What is the closest you could sit to the speakers to enjoy a three-hour (180 minute) concert without suffering hearing damage?

Complete the table below.

Distance from speakers (m)	Loudness of music (dB)
4	106
8	

Refer to:

- Graph 1 (page 8)
- How loud? (page 10)
- Diagram 1 (page 10).

The closest I could sit is because

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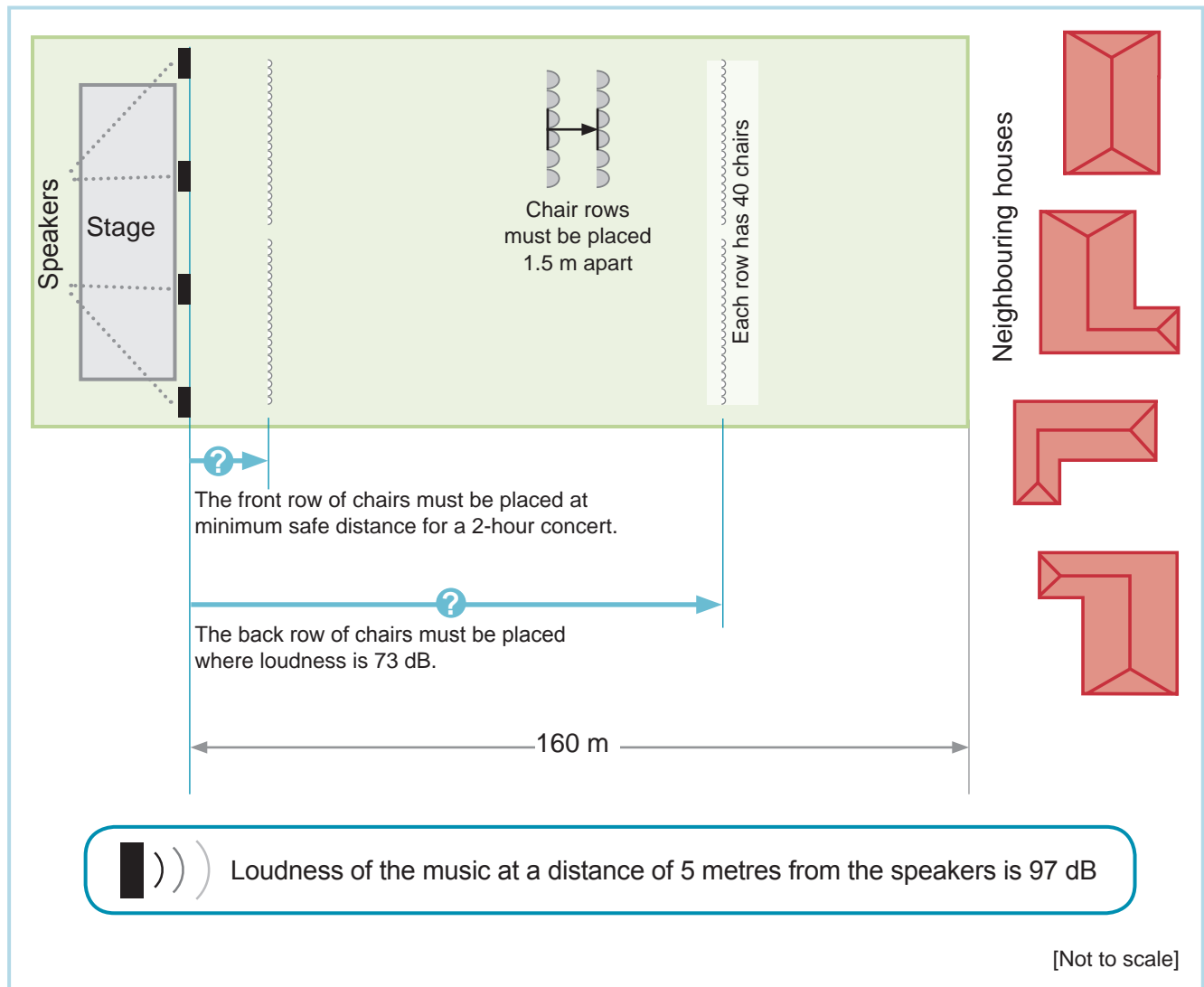
Stop here: Wait for your teacher’s directions

Planning a charity concert

Use mathematical reasoning to plan the following aspects of an outdoor charity concert on a sporting field.

- Number and placement of chairs for safe and enjoyable listening.
- The cost of running the concert.
- How much to charge for tickets.
- Impact of noise on neighbouring houses.

Diagram 2: Setting up an outdoor concert



13. Calculate how many chairs you could place on the field so that:

- ☐ the front row is at the minimum distance for safe listening for 2 hours
- ☐ the music is loud enough for enjoyment (73 dB) in the back row
- ☐ rows of chairs are 1.5 m apart (from the front of one row to the front of the next)
- ☐ there is a total of 40 chairs in each row.

Refer to:

- Graph 1 (page 8)
- How loud? (page 10)
- Diagram 2 (page 12).

State any assumptions you make and show your reasoning.



Show all working

Number of chairs =

Use the information in Table 3 to answer Question 14.

Table 3: Costs and Times for concerts

Costs (All other services have been generously donated)	
Sports field hire	\$ 300 (includes insurance and cleaning)
Security	\$ 120 /hr
Electricity for lights	\$ 20 /hr
Speaker and amplifier hire	\$ 1800
Stage marquee hire	\$ 450
Chair hire	\$ 1.00 /chair for the first 500
	\$ 0.85 /chair for each chair over 500
Times	
Concert time	8 pm to 10 pm
Set-up time	2 hours before concert
Pull-down time	1 hour after concert
Sunset	6 pm

14. Calculate the total cost of running the concert.

State any assumptions you make and show your reasoning.



Show all working

Total cost =

15. How much would you charge for each ticket?

Assume that you:

- pay all running costs from the ticket sales
- hope to raise \$10 000 for charity
- expect to sell tickets for at least 70% of the seats.

State any assumptions you make and show your reasoning.



Show all working

Ticket price =

16. The local council requires you to provide screening to protect the neighbouring houses if the music is annoyingly loud. Will you need to provide screening?

State any assumptions you make and show your reasoning.



Show all working

Guide to making judgments — Year 9 Mathematics

Name

Focus: Apply mathematical reasoning when buying and listening to music, and reflect on understandings to plan an outdoor concert.

Knowledge and understanding	Thinking and reasoning	Thinking and reasoning Reflecting	Communicating
<p>Performs calculations involving cash, credit, rate and time. Analyses graphical data to make inferences about safe sound levels.</p> <p>Questions 1–4, 6, 7, 10</p>	<p>Solves problems involving download rate, interest rate and loudness data, and justifies reasoning.</p> <p>Questions 5, 8, 9, 11, 12</p>	<p>Chooses strategies and procedures to plan physical, financial and safety aspects of an outdoor concert. Justifies reasoning by reflecting on learning and applying understandings.</p> <p>Questions 13–16</p>	<p>Uses mathematical language and representations when communicating, thinking and justifying reasoning.</p> <p>Questions 1–16</p>
<p>◀ Demonstrates consistent success with calculations involving cost, time, discount, deposit and interest; accurately infers from graphical data.</p> <p>◀ Demonstrates proficiency with single-step calculations involving cost and time, and in inferring from graphical data; some success with calculations involving discount, deposit and interest.</p> <p>◀ Demonstrates some success with single-step calculations involving cost and time, and in inferring from graphical data.</p>	<p>◀ Correctly calculates interest rate; uses clear, valid mathematical reasoning to justify a recommendation to borrow or save, a safe listening time and volume for an MP3 player, and a safe listening distance at a concert.</p> <p>◀ Correctly determines download time for music and a safe listening distance at a concert.</p> <p>◀ Determines a safe listening time or volume setting for an MP3 player; makes progress towards determining download time for music and a safe listening distance at a concert; justifies a recommendation to borrow or save.</p> <p>◀ Demonstrates some progress towards determining download time, a safe listening time or volume, or a safe listening distance.</p>	<p>◀ Justifies strategies with accurate and perceptive application of assumptions, understandings and all relevant information.</p> <p>◀ Justifies chair numbers by correctly applying understanding of loudness; uses valid assumptions and sound mathematical reasoning to make decisions on running cost, ticket price and screening.</p> <p>◀ Calculates chair numbers with reference to loudness levels. Calculates running cost and ticket price based on some valid assumptions.</p> <p>◀ Makes some correct calculations involving chair numbers, running cost or ticket price.</p>	<p>A ◀ Clearly communicates procedures, reasoning and justification using mathematical representations, language, working, rounding and units.</p> <p>B</p> <p>C ◀ Shows working and units in most calculations; makes some use of mathematical language in explanations.</p> <p>D</p> <p>E ◀ Occasionally shows working.</p>

Feedback

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