



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA



National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 2 Mathematics, 2006

90292 Solve straightforward trigonometric equations

Credits: Two

2.00 pm Wednesday 29 November 2006

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

Make sure you have a copy of Formulae Sheet L2-MATHF.

You should answer ALL the questions in this booklet.

Show ALL working.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–6 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only			
Achievement Criteria			
Achievement	Achievement with Merit	Achievement with Excellence	
Solve straightforward trigonometric equations.	<input checked="" type="checkbox"/>	Solve trigonometric equations.	<input checked="" type="checkbox"/>
		Solve multi-step trigonometric problems.	<input checked="" type="checkbox"/>
Overall Level of Performance			E

You are advised to spend 25 minutes answering the questions in this booklet.

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QUESTION ONE

Solve the following trigonometric equations.

$$\frac{\sin t}{\tan t} \mid \begin{array}{l} \uparrow \\ \text{cost} \end{array}$$

(a) $\tan x = 0.5$, $0^\circ \leq x \leq 360^\circ$

$$x = 26.57^\circ, \quad \cancel{116.57^\circ}, \quad \cancel{296.57^\circ}$$

additional incorrect
answers = N.

(b) $\sin x + 1 = 0.8$, $0^\circ \leq x \leq 360^\circ$

$$\sin x = -0.2$$

$$x = 168.46^\circ, \quad \cancel{348.46^\circ}$$

(c) $3\cos x = 1.8$, $0 \leq x \leq 2\pi$

$$\cos x = 0.6$$

$$x = 0.927, \quad 5.36$$

QUESTION TWO

Solve $\tan 2x = 4$, $0 \leq x \leq 2\pi$

$$2x = 1.326, \quad 4.467, \quad 7.609, \quad 10.75$$

$$x = 0.663, \quad 2.2335, \quad 3.8045, \quad 5.375$$

QUESTION THREE

Ashleigh is being pushed on a swing by her aunt.

The horizontal distance in metres, d , of the swing from Ashleigh's aunt is given by the equation:

$$d = -1.2 \cos t + 1.2$$

where t is the time, in seconds, after the swing is released.

How much time is the swing **more than 2 m** from her aunt in any one motion of the swing?



Assessor's
use only

$$2 = -1.2 \cos t + 1.2$$

$$\cos t = -\frac{2}{3}$$

~~$$t = 5.4425$$~~

$$t = 2.3 \text{ s}$$

NS

QUESTION FOUR

Sarah and Scott are road bike training.

They begin their training together, at the same time and place.

The distance between Sarah and Scott varies constantly in a regular manner.

The distance that Sarah is ahead of Scott at any time, t , can be modelled by the function

$$D = 5 \sin \frac{\pi t}{30}$$

where D is the distance in metres of Scott from Sarah, and t is in minutes.



After how many minutes will Sarah **first** be **more than 2 metres** ahead of Scott?

$$2 = 5 \sin \frac{\pi t}{30}$$

$$\sin \frac{\pi t}{30} = 0.4$$

$$\frac{\pi t}{30} = 0.415$$

$$t = 3.93 \text{ min}$$

M

Qn 3.

Evidence is not sufficient.

Students are required to find both answers to solve this problem.

also not sufficient to replacement in question 1 as:

~~Qn 3~~ (a) cos equations

already correct in Qn 1c.

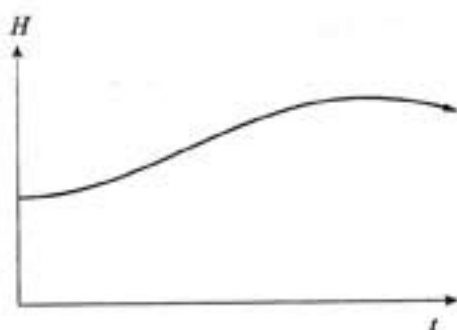
(b) always need both answers to solve equation in A.

Qn 4

Problem solved correctly.

QUESTION FIVE

Sarah has a heart rate monitor attached as she trains on her bike for **one hour**.



Her initial and minimum heart rate is 100 beats per minute.
Her maximum heart rate during the session is 156 beats per minute.

Her heart rate can be modelled by the function

$$H = A \cos \frac{\pi t}{45} + B$$

where t is the time in minutes from the start of the training session
and H is her heart rate in beats per minute.

For how long is Sarah's heart rate above 145 beats per minute during her **one hour** training session?

$$\text{period} = 90 \text{ min}$$

$$\text{Max heart rate} = 45 \text{ min}$$

$$100 = A + B$$

$$156 = -A + B$$

$$2B = 256 \quad A = -28$$

$$B = 128$$

$$H = -28 \cos \frac{\pi t}{45} + 128$$

$$145 = -28 \cos \frac{\pi t}{45} + 128$$

$$\cos \frac{\pi t}{45} = -\frac{17}{28}$$

$$\frac{\pi t}{45} = \cancel{2.22}, \cancel{4.06} \quad 2.22, 4.06$$

$$t = \cancel{31.8}, \cancel{58.15}$$

$$\cancel{58.15} - 31.8 = 26.36$$

~~Answer: 26.36 minutes~~

$$t = 31.8, 58.15$$

$$58.15 - 31.8 = 26.36$$

Answer: 26.36 minutes

Start t
ant cost

* Holistic call - used ~~A~~ evidence of A in E qn as working throughout paper sound.

Student has correctly answered 2/3 merit questions.

Student has correctly answered Excellence qn. with detailed working showing clear evidence of ability to solve multistep trigonometric problems.

If Excellence question had been used to replace M student would get Merit overall but a holistic call was made as student has correctly completed a difficult excellence qn and only they preventing Excellence would be the additional incorrect answer in 1a and the unexplainable wrong answer in 1b.

Assessor's use only

A

Evidence of Achieved

M
E