| To be completed by Candidate and School: | |
|---|---|
| Name: | |
| NSN No: | |
| School Code: | |

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SUPERVISOR'S USE ONLY

**DAY 1**
**TUESDAY**

NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

**QUALIFY FOR THE FUTURE WORLD**
**KIA NOHO TAKATŪ KI TŌ ĀMUA AO!**

# Level 1 Mathematics and Statistics CAT, 2015

## 91027 Apply algebraic procedures in solving problems

Tuesday 15 September 2015
Credits: Four

**You should attempt ALL the questions in this booklet.**

Calculators may NOT be used.

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.

**You are required to show algebraic working in this paper. Guess and check and correct answer only methods do not demonstrate relational thinking and will limit the grade for that part of the question to a maximum of an Achievement grade. Guess and check and correct answer only may only be used a maximum of one time in the paper and will not be used as evidence of solving a problem.**

**A candidate cannot gain Achievement in this standard without solving at least one problem.**

**Answers must be given in their simplest algebraic form.**

**Where a question is given in words you will be expected to write an equation.**

Check that this booklet has pages 2–11 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.**

| ASSESSOR'S USE ONLY | Achievement Criteria | |
|---|---|---|
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Apply algebraic procedures in solving problems. | Apply algebraic procedures, using relational thinking, in solving problems. | Apply algebraic procedures, using extended abstract thinking, in solving problems. |
| | | **Overall level of performance** |

## QUESTION ONE

ASSESSOR'S USE ONLY

(a) Expand $(x + 2)(4x - 5)$

(b) Give the $x$-coordinates of the points where the graph of $y = x(x + 3)$ cuts the $x$-axis.

(c) Rani hired a bike for a ride.
It cost $8 for two hours, and then $3 for every additional hour.
Her ride cost $23.

How long did Rani hire the bike?

(d) Simplify $\dfrac{3ab^2 - 4a^3b + ab^2}{4ab^2}$

ASSESSOR'S USE ONLY

(e) Sam and Jake live 8 km from each other.

Sam skateboards 10 km in the same time as Jake rides his bike 15 km.

If they both leave home at the same time and travel towards each other, how far from Jake's home will they meet?

*You must show the use of algebra.*

(f) Dani is trying to find a value for $c$ so that $x^2 + 6x + c = 0$ has only one solution for $x$.

Find the value for $c$ and the solution to the equation.

## QUESTION TWO

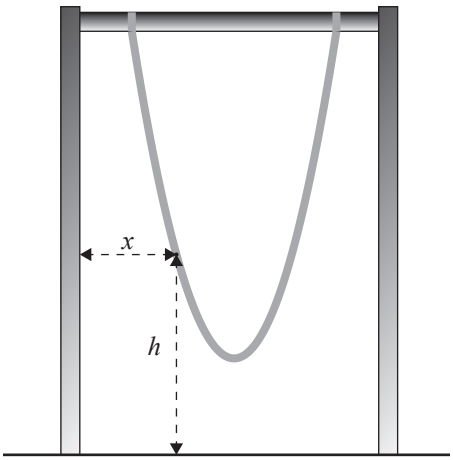
ASSESSOR'S USE ONLY

(a) Factorise $3x^2 - 11x + 6$

(b) A swing is made by attaching two ends of a rope to two different points on a steel frame.

The height $h$ metres of the rope above the ground at a distance $x$ metres from the left-hand side of the frame is modelled by $h = 2x(x - 1.5) + 1$

What is the height above ground of the point on the rope where $x$ is 2?




(c) If $y = x^2 + 3x - 10$, for what values of $x$ will $y$ be negative?

ASSESSOR'S USE ONLY

(d) Sharee has had an operation and needs to build up her strength by walking.

She slowly increases the time for which she walks.

She wants to increase the time for which she walks to 160 minutes each day.

The first week she goes for a 10-minute walk each day.

Each Monday she doubles the time for which she walks each day.

The time for which she walks each day in week $n$ can be modelled by the equation

$$T = 10 \times 2^{n-1}$$

How many weeks will it take her to reach her goal of walking for 160 minutes a day?

(e) Tane is asked to solve the equation:

$$\frac{x^2 - 1}{x^2 + 2x + 1} = \frac{3}{4}$$

Tane's solution is given below

$4(x^2 - 1) = 3(x^2 + 2x + 1)$

$4x^2 - 4 = 3x^2 + 6x + 3$

$x^2 + 6x - 7 = 0$

$(x + 7)(x - 1) = 0$

$x = -7$ or $x = 1$

Tane's teacher tells him he is wrong, as it has only one valid solution.

Explain Tane's mistake.

ASSESSOR'S USE ONLY

(f) A group of people go to a fun park.

There are 38 in the group.

The cost for a student is $10.

The cost for an adult is $12.

The total cost for the group is $420.

How many students were in the group?

## QUESTION THREE

ASSESSOR'S USE ONLY

(a) Jake thinks of a number, adds 5, and multiplies the result by 4.
He gets an answer of 24.

Find the number Jake was thinking of.

(b) A rectangular garden is $n$ metres wide.
Its length is 2 metres longer than its width.

Find a formula for the area of the garden in terms of $n$.

(c) Five people on a camp have a stomach bug.
The bug spreads at a constant rate $r$.
At the end of 3 days, 320 people have the bug.
This can be modelled by:

$$320 = 5r^3$$

Find the rate, $r$, at which the bug is spreading.

ASSESSOR'S USE ONLY

(d) Sarah and Miree are studying for their NCEA exams.

Sarah claims she does more study than Miree.

Miree says she does 3 hours study on each of four days during the week.

Sarah says she studies for two thirds of that time during the week, and at least a further 2 hours on the weekend.

Is Sarah's claim always correct?

Explain your solution.

(e) Samie and Marius earn pocket money by working in a garden.

Marius earns $14 an hour.

Samie earns $4 an hour more than Marius.

Marius works twice as long as Samie.

Together they earn a total of $138.

How much does Samie earn?

(f) The volume of a cylinder is given by $V = \pi r^2 h$ and that of a cone is given by $V = \frac{\pi}{3} r^2 h$.
A cylinder has the same radius as the base of a cone.

If the volume of the cylinder is twice that of the cone, give an expression for the ratio of the height of the cylinder to the height of the cone.

ASSESSOR'S USE ONLY

**Extra paper if required.**
**Write the question number(s) if applicable.**

QUESTION NUMBER

ASSESSOR'S USE ONLY

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