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SUPERVISOR'S USE ONLY

Level 2 Mathematics and Statistics, 2018

91261 Apply algebraic methods in solving problems

9.30 a.m. Wednesday 14 November 2018
 Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Apply algebraic methods in solving problems.	Apply algebraic methods, using relational thinking, in solving problems.	Apply algebraic methods, using extended abstract thinking, in solving problems.

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

You should attempt ALL the questions in this booklet.

Make sure that you have Formulae Sheet L2–MATHF.

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 methods, and correct answer(s) only, will generally limit grades to Achievement.

Check that this booklet has pages 2–12 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.

TOTAL

ASSESSOR'S USE ONLY

QUESTION ONEASSESSOR'S
USE ONLY

- (a) Simplify fully $(25m^{16})^{\frac{1}{2}}$

- (b) Simplify fully $\left(\frac{4}{3a}\right)^{-2}$, leaving your answer with a positive index.

- (c) Write $4 - \frac{b+8c}{3c}$ as a single fraction in its simplest form.

- (d) Factorise fully $4bx + 2xy - 6ab - 3ay$

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- A 3D diagram of a rectangular prism. The length of the base is labeled as 60 cm with a dashed double-headed arrow. The width of the base is labeled as w . The height of the prism is labeled as h .

- (f) $(3x + y)(x - 12y) - (2x + y)(x - 16y)$ can be written in the form $(a + b)^2$.

Find expressions for a and b in terms of x or y .

ASSESSOR'S
USE ONLY

QUESTION TWOASSESSOR'S
USE ONLY

- (a) Find x if $\log_x 243 = 5$

- (b) Find m if $\log_3(4m - 1) = 2$

- (c) Find an expression for x in terms of w if $\frac{3^{4x+1}}{9^x} = 27^{\frac{w}{3}}$

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A diagram of a bridge with a parabolic arch. A horizontal red line segment connects points A and B on the arch. A point Q is marked on the bridge deck below point A.

The arch can be modelled by a function of the form $h(x) = kx(3.6 - x)$, where k is a constant, h metres is the height above the wall, and x metres is the horizontal distance from Q.

How long is the rail AB?

- (e) Interest is compounded on a principal investment, $\$P$, **at the end of each year.**

If the total amount of the investment after n years is $\$A$ then $A = P\left(1 + \frac{r}{100}\right)^n$

where $r\%$ is the compound interest rate per year.

- (i) Anushka invests $\$20\,000$ at an interest rate of 3.85% (so $A = P(1.0385)^n$).

How many years will it take for her investment to be worth $\$25\,000$?

- (ii) Semisi invests his money at a different interest rate than Anushka's investment.
His investment will double in value after twelve years.

What is the interest rate for Semisi's investment?

QUESTION THREEASSESSOR'S
USE ONLY

(a) Solve each of the following equations for x :

(i) $12x^2 - 5x = 2$

(ii) $x + 1 - \frac{3}{x} = 0$

(b) Show that the graph of the function $y = 2x^2 - 5x + 6$ does not cross the x -axis.
You must use algebra to support your explanation.

**Question Three continues
on the following page.**

- (c) The equation $3x^2 + kx - 12 = 0$ has two real solutions.

If one of the solutions is $x = 3$, find the other solution.

- (d) Show that the roots of the equation $x^2 + 2(k + 1)x - (k^2 + 2k + 5) = 0$, where k is a constant, can never be equal for any real number k .

ASSESSOR'S
USE ONLY

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

ASSESSOR'S
USE ONLY

QUESTION
NUMBER

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