Level 2 Mathematics and Statistics: practice paper 2026

AS 91261 Apply algebraic methods in solving problems · Vertex Academy practice paper, not an NZQA paper

Attempt ALL the questions. Show ALL working. Use NZQA's Level 2 formulae sheet. Write your answers on lined paper, or in the space under each question.

QUESTION ONE

(a) Simplify $(2x^3y^2)^3 \div 4x^5y$.

(b) (i) Simplify fully $\dfrac{2x^2 + 7x - 15}{4x^2 - 9}$.

(ii) Hence solve $\dfrac{2x^2 + 7x - 15}{4x^2 - 9} = \dfrac{3}{4}$.

(c) Aroha puts $5000 into a savings account paying 4.2% a year, compounded monthly. Her balance after n months is $B = 5000\left(1 + \frac{0.042}{12}\right)^n$. Form and solve an inequation to find the least number of whole months before her balance is more than $6500.

(d) A council builds a path of the same width, w m, all the way around a rectangular paddling pool. The path's area must equal the pool's area.

(i) The pool is 8 m by 5 m. Form an equation and find w, to 2 decimal places.

(ii) Show that for a pool L m long and W m wide, the path width is $w = \frac{-(L + W) + \sqrt{(L^2 + 6LW + W^2)}}{4}$.

(iii) Explain why, for every rectangular pool, there is exactly one possible path width.

(e) For a camera lens, the distance u cm from the lens to an object, the distance v cm from the lens to its sharp image, and the focal length f cm are linked by $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$.

(i) Make v the subject of the formula.

(ii) A lens has f = 12 cm. Find v when the object is 30 cm away.

(iii) Prove that whenever the object is further away than the focal length (u > f), the image is also further away than the focal length (v > f). Find u, in terms of f, when the image is the same distance from the lens as the object.

QUESTION TWO

(a) Solve $3x^2 - 5x - 4 = 0$, giving your solutions to 2 decimal places.

(b) Find all values of k for which $kx^2 + 4x + (k - 3) = 0$ has two different real roots.

(c) A rectangular banner for a kapa haka festival has a perimeter of 13 m and an area of 10 m². Form and solve a pair of equations to find the length and width of the banner.

(d) Consider the equation $x^2 + (k - 2)x - 2k = 0$, where k is a constant.

(i) Show that the discriminant is $(k + 2)^2$.

(ii) Explain why the equation has real roots for every value of k, and why the roots are rational whenever k is rational.

(iii) Find the value of k that gives equal roots, and find that root.

(e) The line $y = kx - 1$ and the parabola $y = x^2 + 3$ are drawn on the same axes, where k is a constant.
(i) Find the values of k for which the line touches the parabola at exactly one point, and find the coordinates of each point where it touches.
(ii) Find all the values of k for which the line does not meet the parabola at all.

QUESTION THREE

(a) Solve $\log_3(2x - 1) = 4$.

(b) Solve $2(3^{2x}) - 7(3^x) + 3 = 0$. Give any non-exact answer to 3 decimal places.

(c) A car bought new for \$32 000 is worth \$23 120 two years later. Its value, V dollars, t years after it was bought is modelled by $V = 32\,000 \times b^t$.

(i) Find the value of b, and explain what it means.

(ii) Find when the car is first worth less than \$10 000, according to the model.

(d) (i) Let $y = \log_2 x$. Show that $\log_4 x = \frac{y}{2}$ and $\log_8 x = \frac{y}{3}$. Then prove in general that the log of x to base a^n equals $(\frac{1}{n}) \log_a x$, for any base $a > 0$ ($a \neq 1$) and any whole number $n \geq 1$.

(ii) Hence solve $\log_2 x + \log_4 x + \log_8 x = 11$.

(iii) Hence solve $\log_3 x - \log_9 x = \log_9 5$.

(e) In 2026, Town A has 12 000 people and is growing by 3% a year. Town B has 18 000 people and is shrinking by 1.5% a year. Assume both rates stay the same.

(i) Form an inequation and find after how many whole years Town A first has more people than Town B.

(ii) Show that, in general, if a town of P people grows by the factor a each year and a bigger town of Q people changes by the factor b each year ($a > b > 0$), the smaller town overtakes the bigger one after $\log(\frac{Q}{P}) \div \log(\frac{a}{b})$ years. Explain why the populations are not needed separately, only the ratio $\frac{Q}{P}$.

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