

MERIT QUESTIONS ON A TYPICAL NCEA PAPER. (A)

ALGEBRA

Question ONE

<p>(a) Simplify $\frac{x^2 - x - 6}{x^2 + x - 12} = \frac{(x+2)(x-3)}{(x-3)(x+4)}$</p> $= \frac{x+2}{x+4}$	<p>(b) Solve $x^2 + 3x + 2 = 5x + 3$</p> $x^2 + 3x + 2 = (5x+3)(2x-1)$ $x^2 + 3x + 2 = 10x^2 + x - 3$ $0 = 9x^2 - 2x - 5$ $x = 0.865 \text{ and } -0.642$
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Question TWO

<p>(a) If $A = 400 \times (1.2)^n$ calculate n if $A = 900$</p> $900 = 400 \times 1.2^n$ $2.25 = 1.2^n$ $\log 2.25 = \log 1.2^n$ $n \log 1.2 = \log 2.25$ $n = \frac{\log 2.25}{\log 1.2} = 4.45$	<p>(b) Find the only valid solution to</p> $\frac{x^2 - 6x + 8}{x-4} = 5$ $\frac{(x-4)(x-2)}{(x-4)} = 5$ $x-2 = 5$ $x = 7$ <p style="text-align: right;">$x \neq 4$</p>
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Question THREE

<p>(a) Find k if the equation $3x^2 + (k+1)x + 12 = 0$ only has one root.</p> $\Delta = 0$ $(k+1)^2 - 4 \times 3 \times 12 = 0$ $(k+1)^2 = 144$ $k+1 = 12 \text{ or } k+1 = -12$ $k = 11 \text{ or } k = -13$	<p>(b) The equation $x^2 - 6x + 2 = k$ has only one solution. Find k</p> $x^2 - 6x + (2-k) = 0$ $\Delta = 0 \text{ so } 36 - 4 \cdot (2-k) = 0$ $36 = 4(2-k)$ $36 = 8 - 4k$ $4k = -28$ $k = -7$
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CALCULUS

Question ONE

<p>(a) The height of a ball kicked vertically up is $h = 40t - 5t^2$. Find the greatest height the ball will reach.</p> $v = \frac{dh}{dt} = 40 - 10t = 0$ <p style="text-align: center;">at top</p> $t = 4$ <p>Subst $t = 4$ $h = 80 \text{ m}$</p>	<p>(b) Find the minimum y value of the curve $y = 3x^2 - 12x + 5$</p> $y' = 6x - 12 = 0$ <p style="text-align: center;">at Min</p> $x = 2$ $y = 12 - 24 + 5 = -7$
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Question TWO

<p>(a) Find the equation of the tangent to the curve $y = x^3 - 8x$ at the point where $x = 2$</p> $y' = 3x^2 - 8 = 3 \times 4 - 8 = 4$ $x = 2, y = -8$ <p>tan is $y = mx + c$</p> $-8 = 4 \times 2 + c$ $c = -16$ $y = 4x - 16$	<p>(b) For what values of x is the curve $y = x^3 - 2x^2 - 5x$ a decreasing function?</p> $y' = 3x^2 - 4x - 5 = 0$ <p style="text-align: center;">at Max/Min</p> $(x+1)(x-5) = 0$ $x = -1, 5$ <p>decreases from A to B so $-1 < x < 5$</p>
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Question THREE

<p>(a) The velocity of a model car at t secs is $v = 5 + 2t$. Find how far the car will move in the 3rd second (from $t = 2$ to $t = 3$)</p> $\frac{dx}{dt} = v = 5 + 2t$ $x = 5t + t^2 + c$ <p>$t = 2$ so $x_1 = 10 + 4 + c$</p> $x_1 = 14 + c$ <p>$t = 3$ so $x_2 = 15 + 9 + c$</p> $= 24 + c$ <p>So moves 10 m in 3rd sec.</p>	<p>(b) The equation of a curve is $y = x^2 + ax + b$ and it passes through $(1, 8)$. If the gradient at $x = 1$ is 6, find a and b.</p> $y' = 2x + a$ <p>If $x = 1$ $y' = 6$</p> $\text{So } 2 + a = 6$ $a = 4$ <p>So $y = x^2 + 4x + b$</p> <p>Sub $x = 1, y = 8$</p> $8 = 1 + 4 + b$ $8 = 5 + b$ $3 = b$ <p style="border: 1px solid black; padding: 5px; display: inline-block;">So $a = 4, b = 3$</p>
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