# Assessment Schedule – 2020

# Mathematics and Statistics: Apply algebraic methods in solving problems (91261)

## Evidence

| Q ONE | Evidence | Achievement (u) | Achievement with Merit (r) | Achievement with Excellence (t) |
|---|---|---|---|---|
| (a) | $(6x - 5)(x + 3)$ | Correctly factorised. | | |
| (b) | $f(x) = x^2 + 10x + 22$<br>$f(x) = (x + 5)^2 - 3$ | Square completed correctly. | | |
| (c)(i) | Substitute $x = 4$, $y = 40$:<br>$40 = 4^3 - 12P \times 4 + R$<br>$40 = 64 - 48P + R$<br>$48P = 24 + R$<br>Rearrange to get $P = \dfrac{24+R}{48}$ | Substitute correctly. | Find an equivalent expression for $P$ in terms of $R$. | |
| (c)(ii) | $3x^2 = 12P$<br>$x^2 = 4P$<br>$x = \pm\sqrt{4P}$<br>$x = \pm 2\sqrt{P}$<br>$x = \pm 2P^{0.5}$<br>However, point B has a negative $x$-value, so $x = -2P^{0.5}$ | Correctly solves the equation to the point where<br>$x = 2P^{0.5}$<br>OR $x = 2\sqrt{P}$<br>OR $x = \pm\sqrt{4P}$<br>($\pm$ required) | Finds $x = \pm 2P^{0.5}$ | T1: Correct working and mathematical statements including an explanation for only using the negative value. |
| (c)(iii) | Co-ordinates of B:<br>$y = (-2P^{0.5})^3 - 12P(-2P^{0.5}) + R$<br>$y = 16P^{1.5} + R$<br>Orange line length = $(16P^{1.5} + R) - R = 16P^{1.5}$<br>For three $x$-intercepts, orange > blue<br>$16P^{1.5} > R$<br>$\sqrt[2]{P^3} > \dfrac{R}{16}$<br>$P^3 > \left(\dfrac{R}{16}\right)^2$ | | Length of orange line obtained. | T1: Recognition and statement that $16P^{1.5} > R$<br><br>T2: Correct result derived with correct mathematical statements. |

| N0 | N1 | N2 | A3 | A4 | M5 | M6 | E7 | E8 |
|---|---|---|---|---|---|---|---|---|
| No response; no relevant evidence. | A valid attempt at one question. | 1 of u | 2 of u | 3 of u | 1 of r | 2 of r | T1 | T2 or two T1 |

| Q TWO | Evidence | Achievement (u) | Achievement with Merit (r) | Achievement with Excellence (t) |
|---|---|---|---|---|
| (a) | $\log\left(\frac{9y \times 4}{3y}\right) = \log(12)$ | Correct solution. | | |
| (b)(i) | $x^2 = 36$<br>$x = 6$ | Correct solution. | | |
| (b)(ii) | $\log_5(2x^2) = 4$<br>$2x^2 = 5^4 = 625$<br>$x^2 = 312.5$<br>$x = \pm 17.68$ (4sf)<br>$x > 0$, so only solution is $x = 17.68$ | Combines logs in a valid way. | Finds $x$. | T1: Correct solution with negative value rejected. |
| (c) | $\frac{(5x+4)(2x+1)-(3x-4)(x+4)}{(x+4)(2x+1)} = 2$<br>$\frac{10x^2+13x+4-[3x^2+8x-16]}{(x+4)(2x+1)} = 2$<br>$\frac{7x^2+5x+20}{2x^2+9x+4} = 2$<br>$7x^2 + 5x + 20 = 4x^2 + 18x + 8$<br>$3x^2 - 13x + 12 = 0$<br>$(3x - 4)(x - 3) = 0$<br>Either $x = \frac{4}{3}$ or $x = 3$<br>OR<br>$5x+4 \quad \frac{(x+4)(3x \quad 4)}{2x+1} = 2(x+4)$<br>$(5x + 4)(2x + 1) - (x + 4)(3x - 4) = 2(x + 4)(2x + 1)$<br>$7x^2 + 5x + 20 = 4x^2 + 18x + 8$<br>$3x^2 - 13x + 12 = 0$<br>$(3x - 4)(x - 3) = 0$<br>Either $x = \frac{4}{3}$ or $x = 3$ | Begins to handle denominators in a correct way (adding the fractions using a common denominator or multiplying through by one denominator). | Correct solutions. | |
| (d) | $\mathrm{a}x^2 + \mathrm{b}x + \mathrm{c} = \mathrm{d}x^2 + \mathrm{e}x + \mathrm{c}$<br>$(\mathrm{a} - \mathrm{d})x^2 + (\mathrm{b} - \mathrm{e})x = 0$<br>$x[(\mathrm{a} - \mathrm{d})x + (\mathrm{b} - \mathrm{e})] = 0$<br>so $x = 0$ or $x = \frac{e \quad b}{a \quad d}$<br>One solution will always be on the $y$-axis, i.e. $x = 0$.<br>The other is $\frac{e \quad b}{a \quad d}$. Hence, there will always be one solution, and there will always be a second as long as $\mathrm{a} \neq \mathrm{d}$ so that this second solution is defined and $\mathrm{b} \neq \mathrm{e}$, so that the second is distinct from the first.<br>Accept alternative method: use of quadratic formula to derive the same results. | Sets up simultaneous equation. | Solves quadratic correctly but does not draw conclusions from the solutions. | T1: Correct working leading to one of the constraints, clearly expressed.<br><br>T2: Correct working leading to both of the constraints, clearly expressed. |

| N0 | N1 | N2 | A3 | A4 | M5 | M6 | E7 | E8 |
|---|---|---|---|---|---|---|---|---|
| No response; no relevant evidence. | A valid attempt at one question. | 1 of u | 2 of u | 3 of u | 1 of r | 2 of r | T1 | T2 or two T1 |

| Q<br>THREE | Evidence | Achievement (u) | Achievement with Merit (r) | Achievement with Excellence (t) |
|---|---|---|---|---|
| (a) | $3^{4x} = 30$<br>$4x\log 3 = \log 30$<br>$x = \frac{1}{4}\left(\frac{\log 30}{\log 3}\right) = 0.7740\ (4\text{sf})$ | Expanded log form. | Correct solution. | |
| (b)(i) | $x = W^{\frac{5}{2}} \quad 2 = \sqrt{W^5} \quad 2$ | Correct expression. | | |
| (b)(ii) | $(x+2)^{\frac{2}{5}} < 20$<br>$x < 20^{2.5} \quad 2$<br>$x < 1786.85$<br>So $x \quad 1786$ or $x < 1787$. | Solves equation to find $x$ = 1786.85. | Correct solution for $x$ as a whole number. | |
| (c)(i) | Turnover = $(2d + 5)(101 – 3d) = 445$<br>$–6d^2 + 187d + 60 = 0$<br>Either $d = –0.3176$ or $d = 31.48$ (4sf)<br>$d$ needs to be both positive and whole, so neither solution is valid, which means that the turnover is never $445. | Forms the correct equation for turnover. | Finds the values of $d$. | T1: Gives a valid explanation as to why the turnover is never $445. |
| (c)(ii) | $(2d + 5)(101 – 3d) = k$<br>$–6d^2 + 187d + (505 – k) = 0$<br>$d = \frac{187 \pm \sqrt{187^2 \quad 4(\ 6)\ \ (505 \quad k)}}{2(\ 6)}$<br>$d = \frac{187 \pm \sqrt{47089 \quad 24k}}{12}$<br>1. Discriminant needs to be positive (so $k < 1962.04$)<br>2. $d$ is rational so $47089 – 24k$ must be a square number<br>3. $d$ is an integer, so $187 \pm \sqrt{47089 \quad 24k}$ must be divisible by 12<br>4. $d$ is positive, so $187 \pm \sqrt{47089 \quad 24k}$ must be positive. | Rearrangement of equation set to 0. | Finds a simplified expression for $d$. | T1: Makes ONE of the listed conclusions.<br><br>T2: Makes TWO of the listed conclusions. |

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|---|---|---|---|---|---|---|---|---|
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## Cut Scores

| Not Achieved | Achievement | Achievement with Merit | Achievement with Excellence |
|---|---|---|---|
| 0 – 7 | 8 – 13 | 14 – 18 | 19 – 24 |