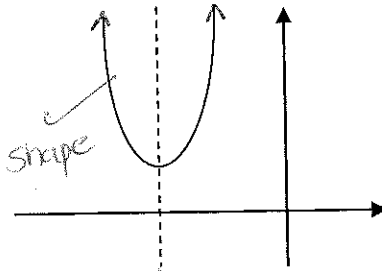


<p>Q1</p> <p>1.1.1</p> <p>1.1.2</p>	$x(x^2 + 3x - 7) = 0$ $x = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-3 \pm \sqrt{3^2 - 4(1)(-7)}}{2(1)}$ $x = 1,54 \quad \text{or} \quad x = -4,54$	<p>✓</p> <p>✓ in subst.</p> <p>✓✓ full marks for ans. 4</p>
<p>1.2.1</p>	$x + 6 \geq 0 \quad x \neq -6$ $\therefore x > 6$ $x + 3 < 0$ $x < -3$ $\therefore -6 < x < -3$	<p>✓ in logic</p> <p>✓✓</p> <p>3</p>
<p>1.2.2</p>	$5^{x+2} - 5^{x+1} = \frac{124}{\sqrt{5}}$ $5^x(5^2 - 5^1) = \frac{124}{\sqrt{5}}$ $5^x \left(\frac{124}{5}\right) = \frac{124}{\sqrt{5}}$ $5^x = \frac{124}{\sqrt{5}} \times \frac{5}{124}$ $5^x = \sqrt{5}$ $5^x = 5^{\frac{1}{2}}$ $\therefore x = \frac{1}{2}$	<p>✓ in factorise</p> <p>✓ isolating 5^x</p> <p>✓ same base</p> <p>✓ equate expo</p> <p>4</p>
<p>1.3.</p>	$2^k = 1 \quad 2^k = -2 \quad 2^k = 6$ $2^k = 2^0 \quad \text{no sol.} \quad k = \log_2 6$ $k=0 \quad \quad \quad = 2,58$	<p>5</p>

De Jell

<p>1.4.</p>	<p>From (1) $q = 2 - 3p$ (2) $q^2 + p - q = pq$</p> <p>$(2 - 3p)^2 + p - (2 - 3p) = p(2 - 3p)$ $4 - 12p + 9p^2 + p - 2 + 3p = 2p - 3p^2$ $12p^2 - 10p + 2 = 0$ $6p^2 - 5p + 1 = 0$ $(3p - 1)(2p - 1) = 0$ $p = \frac{1}{3}$ or $p = \frac{1}{2}$</p> <p>$q = 2 - 3\left(\frac{1}{3}\right) = 1$ $q = 2 - 3\left(\frac{1}{2}\right) = \frac{1}{2}$</p>	<p>✓ A subject of brm.</p> <p>✓ m subst</p> <p>✓ A std form</p> <p>✓ p values</p> <p>✓ q values</p> <p>5</p>
<p>1.5.</p>		<p>✓ AOS ⊖</p> <p>✓ No Roots</p> <p>3</p>
<p>1.6.</p>	<p>Sum of numerator = $\frac{1}{2}n^2 + \frac{1}{2}n$</p> <p>$= \frac{1}{2}(180)^2 + \frac{1}{2}(180)$</p> <p>$= 16290$</p> <p>Value = $\frac{16290}{181} = 90$</p>	<p>✓ pattern</p> <p>✓ A</p> <p>✓</p> <p>4</p>

OR

$$d = \frac{1}{181} \quad n = 180$$

$$S_{180} = \frac{180}{2} \left[2C \left(\frac{1}{181} \right) + (180 - 1) \frac{1}{181} \right]$$

$$= 90$$

<p>Q2 2.1.1</p>	<p>log 5; 2 log 5; 3log 5;...</p> <p>2log5 – log 5 3log5-2 log5 ✓ =log5 = log 5 ✓</p> <p>Common difference ∴ arithmetic</p>	<p style="text-align: right;">2</p>
<p>2.1.2</p>	<p>$S_n = \frac{n}{2} [2a + (n - 1)d]$</p> <p>$= \frac{10}{2} [2\log 5 + 9 \log 5]$</p> <p>$= 5 (11 \log 5)$</p> <p>$= 55 \log 5$</p> <p>$= 38,44$ →</p>	<p style="text-align: right;">3.</p>
<p>2.2.</p>	<p>r=5 a= 5 Sn = 500 000</p> <p>$S_n = \frac{a(r^n - 1)}{r - 1}$</p> <p>$500000 = \frac{5(5^n - 1)}{5 - 1}$ (or <)</p> <p>$\frac{500000 \times 4}{5} = 5^n - 1$</p> <p>$5^n = 400001$</p> <p>$n = \log_5 400001$</p> <p>$= 8,01$</p> <p>∴ 9 terms</p>	<p style="text-align: right;">4.</p>
<p>2.3.</p>	<p>$r = \frac{4x^3}{8x^2} = \frac{1}{2}x$</p> <p>$-1 < \frac{x}{2} < 1$</p> <p>$- 2 < x < 2$</p>	<p style="text-align: right;">3.</p>
<p>2.4.</p>	<p>3; 6;12;... r =2</p> <p>$S_n = \frac{a(r^n - 1)}{r - 1}$</p> <p>$93 = \frac{3(2^n - 1)}{2 - 1}$</p> <p>$31 = 2^n - 1$</p> <p>$32 = 2^n$</p> <p>$n = 5$</p> <p>∴ m = 5</p>	<p style="text-align: right;">5</p>

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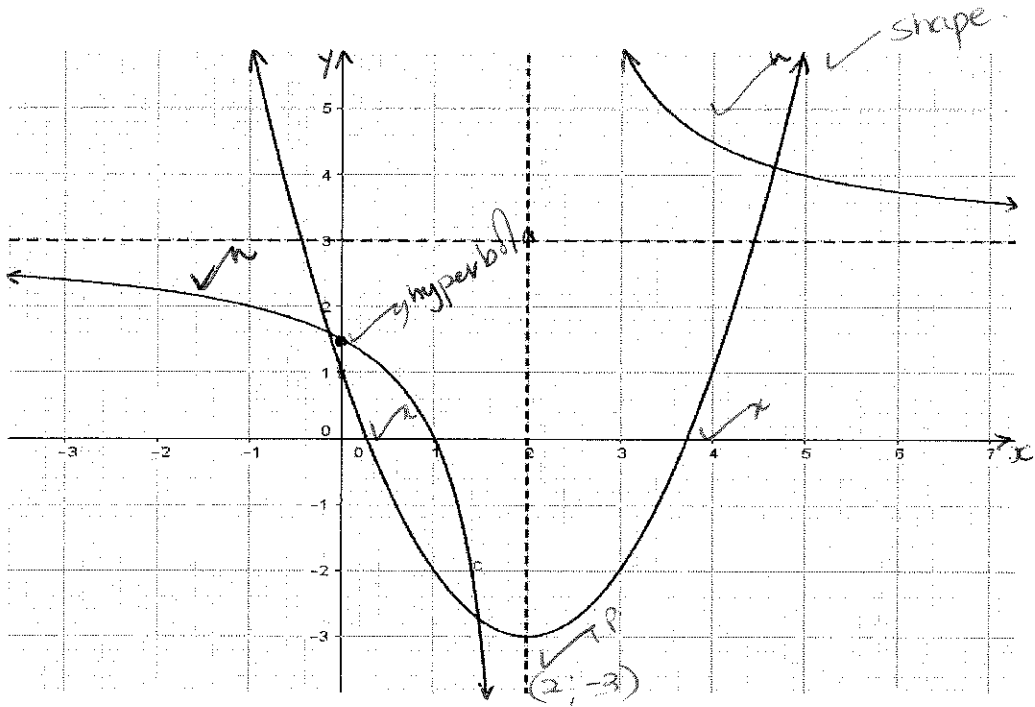
Q3.

3.1. $x = 2$ ✓

$y = 3$ ✓

2

3.2.



7

3.3.1.

$1 < x < 2$ ✓

2

3.3.2.

$k = 3$ ✓

2

<p>Q4 4.1</p>	<p>$f: y = a^x$ $25 = a^{-2}$ $5^2 = (a^{-1})^2$ $\therefore (a^{-1}) = (5)^{-1}$ $a = 5$ ✓</p> <p>$h: y = \log_p x$ $3 = \log_p 64$ ✓ $p^3 = 64$ $p^3 = 4^3$ $p = 4$ ✓</p>	<p style="text-align: right;">4.</p>
<p>4.2.</p>	<p>H (-5 ; 0) E (5 ; 0) L (1 ; 0) P (0 ; 1)</p>	<p>✓ ✓ ✓ ✓</p> <p style="text-align: right;">4.</p>
<p>4.3.</p>	<p>$x^2 + y^2 = 25$ $y^2 = 25 - x^2$ $y = \sqrt{25 - x^2}$</p>	<p>✓ m. circle ✓ y =</p> <p style="text-align: right;">2.</p>
<p>4.4.</p>	<p>$y = x$ $y = \sqrt{25 - x^2}$</p> <p>$\therefore x = \sqrt{25 - x^2}$ $x^2 = 25 - x^2$ $2x^2 = 25$ $x^2 = \frac{25}{2}$ $x = \sqrt{\frac{25}{2}}$ $= \frac{5}{\sqrt{2}}$</p> <p>S ($\frac{5}{\sqrt{2}}; \frac{5}{\sqrt{2}}$) or ($\frac{5\sqrt{2}}{2}; \frac{5\sqrt{2}}{2}$)</p>	<p>✓ m. = ✓ A. ✓ (x, y)</p> <p style="text-align: right;">3.</p>
<p>4.5.</p>	<p>$y = \log_4 x$ $x = \log_p y$ ✓ $h^{-1}(x) = 4^x$ or 2^{2x}</p>	<p>✓</p> <p style="text-align: right;">2.</p>
<p>4.6.</p>	<p>$y > 2; y \in \mathbb{R}$</p>	<p>✓</p> <p style="text-align: right;">2.</p>

<p>Q5 5.1.</p>	$3x = x\left(1 + \frac{0,082}{2}\right)^{2n}$ $3 = \left(1 + \frac{0,082}{2}\right)^{2n}$ $2n = \log\left(1 + \frac{0,082}{2}\right) 3$ $2n = 27,34$ $n = 14 \text{ years}$ <p style="text-align: center;">accept 13, ...</p>	<p>✓ 3x d, x ✓ ✓ ✓</p> <p style="text-align: right;">4.</p>
<p>5.2.1</p>	$Pv = \frac{x[1-(1+i)^{-n}]}{i}$ $10000 = \frac{x[1-(1+\frac{0,095}{12})^{-24}]}{\frac{0,095}{12}}$ $x = \frac{10000 \times \frac{0,095}{12}}{[1 - (1 + \frac{0,095}{12})^{-24}]}$ $= R459,14$	<p>✓ ✓ ✓</p> <p style="text-align: right;">3.</p>
<p>5.2.2</p>	$10000\left(1 + \frac{0,095}{12}\right)^{20}$ $= R11\,708,26$ $Fv = \frac{459,14[(1 + \frac{0,095}{12})^{20} - 1]}{\frac{0,095}{12}}$ $= R9\,907,36$ $\text{Balance} = 11\,708,26 - 9\,907,36$ $= R\,1800,90$ <p>OR</p> $Pv = \frac{x[1-(1+i)^{-n}]}{i}$ $= \frac{459,14[1-(1+\frac{0,095}{12})^{-4}]}{\frac{0,095}{12}}$ $= R1800,78$	<p>✓ ✓ ✓ ✓</p> <p style="text-align: right;">4.</p>

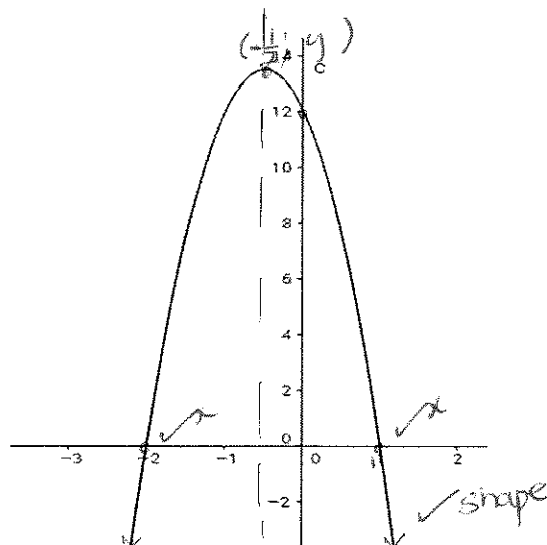
<p>5.3.1</p>	$A = P(1+i)^n$ $= 320\,000(1+0,075)^{10}$ $= R659\,530,10$	<p>✓ ✓ ✓ A</p> <p style="text-align: right;">3</p>
<p>5.3.2</p>	$R659\,530,10 - R30\,000$ $= R629\,530,10$ $Fv = \frac{x[(1+\frac{0,144}{4})^{40}-1]}{\frac{0,144}{4}}$ $629\,530,10 = \frac{x[(1+\frac{0,144}{4})^{40}-1]}{\frac{0,144}{4}}$ $\frac{629530,10 \times \frac{0,144}{4}}{[(1 + \frac{0,144}{4})^{40} - 1]} = x$ $x = R7\,275,02$	<p>✓ Bal.</p> <p>✓ Fv =</p> <p>✓ x</p> <p>✓</p> <p>✓</p> <p style="text-align: right;">5</p>

Q6		

<p>Q6 6.1.1</p>	$y = \frac{x^2}{x} - \frac{3}{x} + \frac{x}{x}$ $= x - 3x^{-1} + 1$ $\frac{dy}{dx} = 1 + 3x^{-2}$ $= 1 + \frac{3}{x^2}$	<p>✓ m</p> <p>✓ A A notation</p> <p>3</p>
<p>6.1.2</p>	$m(x) = 2x^2 + 7$ $m(j(x)) = 2(\sqrt{x})^2 + 7$ $= 2x + 7$ $\frac{dm}{dx} = 2$	<p>✓</p> <p>✓</p> <p>✓ A.</p> <p>3</p>
<p>6.1.3</p> <p>check</p>	$f(x) = x^2 - 4x + 1$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{(x+h)^2 - 4(x+h) + 1 - x^2 + 4x - 1}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 4x - 4h + 1 - x^2 + 4x - 1}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 - 4h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h - 4)}{h}$ $= \lim_{h \rightarrow 0} 2x + h - 4$ $= 2x - 4$	<p>-1 for notation</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓ A</p> <p>5</p>

<p>6.2. 6.2.1</p>	$g(x) = -2x^3 - 3x^2 + 12x + 20$ $= (x + 2)(-2x^2 + x + 10)$ $= (x + 2)(-2x + 5)(x + 2)$ <p>A(-2;0) B($\frac{5}{2}$; 0)</p> <p>AB = 4,5 units</p>	<p>✓✓</p> <p>✓✓</p> <p style="text-align: right;">4</p>
<p>6.2.2</p>	$g'(x) = -6x^2 - 6x + 12$ $x^2 + x - 2 = 0$ $(x + 2)(x - 1) = 0$ $x = -2 \text{ or } x = 1$ <p>T(1; 27)</p>	<p>✓ $m_{g(x)} = 0$</p> <p>✓✓</p> <p style="text-align: right;">3</p>
<p>6.2.3</p>	$g'(-3) = -6(-3)^2 - 6(-3) + 12$ $= -24$ <p>Eq. of tangent: $y = -24x + c$</p> <p>Sub(-3;11) $11 = -24(-3) + c$</p> $c = -61$ <p>$y = -24x - 61$</p>	<p>✓ m (grad)</p> <p>✓ A</p> <p>✓</p> <p style="text-align: right;">3</p>
<p>6.2.4</p>	<p>$0 < k \leq 27$ ✓</p>	<p style="text-align: right;">3</p>
<p>6.2.5</p>	$g''(x) = -12x - 6$ $-12x - 6 = 0$ $x = \frac{6}{-12}$ $= -\frac{1}{2}$	<p>✓ $g''(x) = 0$</p> <p>✓</p> <p style="text-align: right;">2</p>

6.2.6



4

<p>Q7 7.1</p>	<p>Rate of change = $\frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{5-3}{2-1}$ $= 2$ 2 million per minute</p>	<p>✓ m ✓ A</p>
<p>7.2.</p>	<p>2 minutes</p>	<p>✓</p>
<p>7.3.</p>	<p>After 3 minutes</p>	<p>✓</p>
<p>7.4.</p>	<p>1 million</p>	<p>✓</p>
<p>Q8</p>		<p>(7)</p>
<p>8.1.</p>	<p>P(start with D end S) = $\frac{4!}{6!}$ $= \frac{1}{30}$</p>	<p>num ✓ denom ✓ ✓ A</p> <p>3</p>
<p>8.2.</p>	<p>4! × 4! × 3! × 3! × 2! $= 41\,472$ ✓</p>	<p>4</p>
<p>8.3.</p>	<p>P(red and E₂) = $\frac{\frac{12}{20} \times \frac{2}{8}}{\left(\frac{8}{20} \times \frac{3}{8}\right) + \left(\frac{12}{20} \times \frac{2}{8}\right)}$ ✓ $= \frac{1}{2}$ ✓ A</p>	<p>Tree correct ✓</p> <p>5</p>

<p>Q9 9.1</p>	$4h + 8r = 120$ $h = \frac{120 - 8r}{4}$ $= \frac{4(30 - 2r)}{4}$ $= 30 - 2r$	<p>✓</p> <p>✓ cf 4 / cancel.</p> <p>2</p>
<p>9.2.</p>	$\text{Volume} = \pi r^2 \times h$ $= \pi r^2 \times (30 - 2r)$ $= 30\pi r^2 - 2\pi r^3$ $\frac{dv}{dx} = 60\pi r - 6\pi r^2$ $\text{let } \frac{dv}{dx} = 0$ $60\pi r - 6\pi r^2 = 0$ $6\pi r(10 - r) = 0$ $6\pi r = 0 \quad \text{OR } 10 - r = 0$ $r = 0 \quad \quad \quad r = 10$ <p>N/A</p> $\therefore \text{radius} = 10\text{cm}$ $\text{Largest Volume} = 30\pi r^2 - 2\pi r^3$ $= 30\pi(10)^2 - 2\pi(10)^3$ $= 1000\pi$	<p>✓</p> <p>✓</p> <p>✓ 10.</p> <p>✓</p> <p>✓</p> <p>5</p>

