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NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1 MEMORANDUM

SEPTEMBER 2016

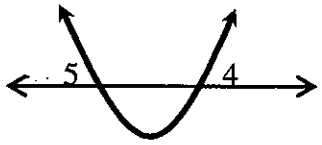
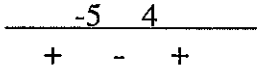
MARKS: 150

This memorandum consists of 20 pages.

NOTE:

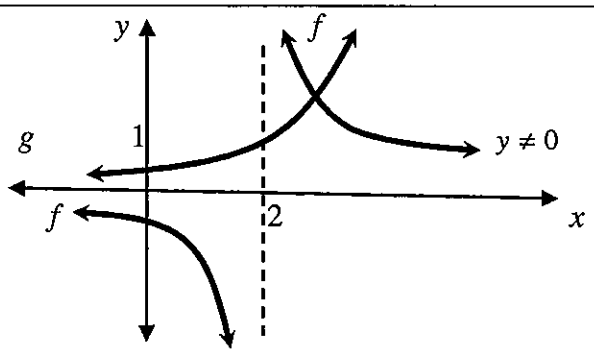
- If a candidate answered a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

QUESTION 1

1.1.1	$7x(2x-1)=0$ $7x=0$ or $2x-1=0$ $x=0$ $\quad 2x=1$ $x=\frac{1}{2}$	✓ $x=0$ ✓ $x=\frac{1}{2}$ (2)
1.1.2	$2x^2+x=4$ $2x^2+x-4=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-1\pm\sqrt{1^2-4(2)(-4)}}{2(2)}$ $=\frac{-1\pm\sqrt{33}}{4}$ $x=1{,}19$ or $x=-1{,}69$	✓ standard form ✓ substitution into the correct formula ✓ $x=1{,}19$ ✓ $x=-1{,}69$ (4)
1.1.3	$(x-4)(x+5)\geq 0$ $\therefore x\leq -5$ or $x\geq 4$  **OR**  $(-\infty;-5]\cup[4;\infty)$	✓ $x\leq -5$ ✓ $x\geq 4$ ✓ or (3) ✓ $x\in(-\infty;-5]$ ✓ $x\in[4;\infty)$ ✓ or (3)

1.1.4	$3x^{\frac{2}{5}} - 5x^{\frac{1}{5}} - 2 = 0$ Let $x^{\frac{1}{5}} = k$ $\therefore 3k^2 - 5k - 2 = 0$ $(3k + 1)(k - 2) = 0$ $3k = -1 \quad \text{or} \quad k = 2$ $k = -\frac{1}{3}$ $x^{\frac{1}{5}} = -\frac{1}{3} \quad \text{or} \quad x^{\frac{1}{5}} = 2$ $x = \left(-\frac{1}{3}\right)^5 \qquad x = 2^5$ $x = -\frac{1}{243} \qquad x = 32$ **OR** $3x^{\frac{2}{5}} - 5x^{\frac{1}{5}} - 2 = 0$ $(3x^{\frac{1}{5}} + 1)(x^{\frac{1}{5}} - 2) = 0$ $3x^{\frac{1}{5}} = -1 \quad \text{or} \quad x^{\frac{1}{5}} = 2$ $x^{\frac{1}{5}} = -\frac{1}{3} \qquad x = 2^5$ $x = \left(-\frac{1}{3}\right)^5 \qquad x = 32$ $x = -\frac{1}{243}$	✓ factors ✓ $x^{\frac{1}{5}} = -\frac{1}{3}$ of $x^{\frac{1}{5}} = 2$ ✓ $x = -\frac{1}{243}$ ✓ $x = 32$ (4) ✓ factors ✓ $x^{\frac{1}{5}} = -\frac{1}{3}$ or $x^{\frac{1}{5}} = 2$ ✓ $x = -\frac{1}{243}$ ✓ $x = 32$ (4)
1.2	$\frac{2x}{1+y} = 1;\ y \neq -1$ and $(3x - y)(x + y) = 0$ $2x = 1 + y$ $2x - 1 = y$ $(3x - y) = 0 \quad \text{or} \quad x + y = 0$ $3x - (2x - 1) = 0 \quad \text{or} \quad x + (2x - 1) = 0$ $x = -1 \quad \text{or} \quad 3x = 1$ $x = \frac{1}{3}$ $y = 2(-1) - 1 \quad \text{or} \quad y = 2\left(\frac{1}{3}\right) - 1$ $= -3 \qquad = -\frac{1}{3}$ **OR**	✓ $2x - 1 = y$ ✓ two factors = 0 ✓ substitution ✓ both x-values ✓✓ y-values (6)

	$\frac{2x}{1+y} = 1;\ y \neq -1$ and $(3x - y)(x + y) = 0$ $2x = 1 + y$ $2x - 1 = y$ $(3x - (2x - 1))(x + (2x - 1)) = 0$ $(x + 1)(3x - 1) = 0$ $x = -1$ or $3x = 1$ $x = \frac{1}{3}$ $y = 2(-1) - 1$ or $y = 2\left(\frac{1}{3}\right) - 1$ $= -3$ $= -\frac{1}{3}$	✓ $2x - 1 = y$ ✓ substitution ✓ factors = 0 ✓ both x-values ✓✓ y-values (6)
	OR $\frac{2x}{1+y} = 1;\ y \neq -1$ and $(3x - y)(x + y) = 0$ $2x = 1 + y$ $x = \frac{1+y}{2}$ $(3x - y) = 0$ or $(x + y) = 0$ $3\left(\frac{1+y}{2}\right) - y = 0$ $\frac{1+y}{2} + y = 0$ $3(1 + y) = 2y$ $1 + y = -2y$ $3 + 3y = 2y$ $3y = -1$ $y = -3$ $y = -\frac{1}{3}$ $x = \frac{1-3}{2}$ or $x = \frac{1-\frac{1}{3}}{2}$ $x = -1$ $x = \frac{1}{3}$	✓ $x = \frac{1+y}{2}$ ✓ two factors = 0 ✓ substitution ✓ both y-values ✓✓ x-values (6)
1.3	$f(x)$ a hyperbola with asymptotes $y = 0$ and $x = 2$. Range of f: $y > 0$ ór $y < 0$. $g(x)$ is an increasing exponential function translated 2 units right, thus $y > 0$ for all $x \in$ R. Therefore f and g intersect only once.	✓ f is hyperbola; $y > 0$ ór $y < 0$ ✓ g: range of g: $y > 0$ (increasing exponential) ✓ explanation (3)

	OR  	✓ *f*: hyperbola sketch; ✓ *g*: sketch of *g* ✓ *g*: explanation: If $x < 2$: $g(x) > 0$, $f(x) < 0$ thus no root. If $x > 2$: $g(x) > 0$, $f(x) > 0$ thus one root only (3) **[22]**

QUESTION 2

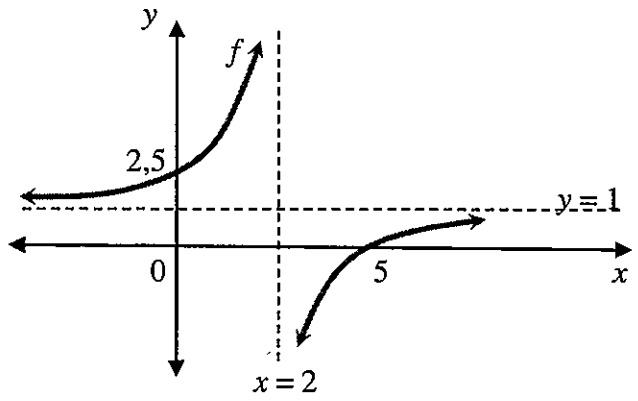
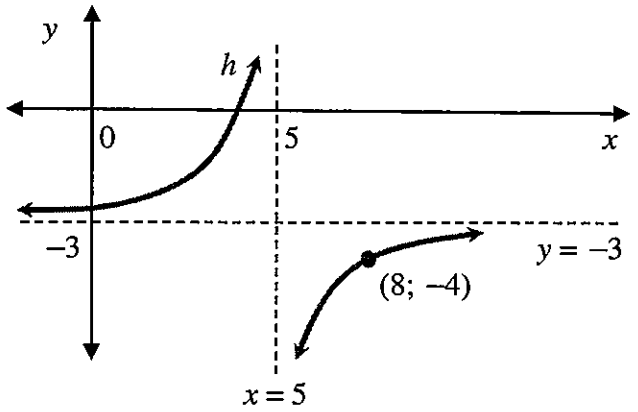
2.1.1	1st differences: $2x; 3x; 4x$	✓ first 3 terms (1)
2.1.2	$T_{100} = 101x$	✓ $101x$ (1)
2.1.3	2 ; 6 ; 12 ; 20 4 6 8 2 2 $2a = 2$ $a = 1$ $T_2 - T_1 = 3a + b$ $4 = 3(1) + b$ $b = 1$ $T_1 = a + b + c$ $2 = 1 + 1 + c$ $c = 0$ $\therefore T_n = n^2 + n$	✓ second difference = 2 ✓ $a = 1$ ✓ $b = 1$ ✓ $c = 0$ (4)
2.2.1	$\frac{T_2}{T_1} = \frac{T_3}{T_2}$ $\frac{x}{54} = \frac{6}{x}$ $x^2 = 324$ $x = \pm 18$	✓ $\frac{x}{54} = \frac{6}{x}$ ✓ $x = \pm 18$ (2)

2.2.2	$r = \frac{T_2}{T_1}$ $= \pm\frac{18}{54}$ $= \pm\frac{1}{3}$ $\therefore -1 < r < 1$ $\therefore$ converging sequence	✓ $r = \pm\frac{1}{3}$ ✓ $-1 < r < 1$ ✓ converging (3)
2.3	$11 + 14 + 17 + \ldots = 4k$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $4k = \frac{56}{2}[2(11) + (55)(3)]$ $4k = 5236$ $k = 1309$ **OR** $11 + 14 + 17 + \ldots = 4k$ $S_n = \frac{n}{2}[a + l]$ $4k = \frac{56}{2}[11 + 176]$ $4k = 5236$ $k = 1309$	✓ $11 + 14 + 17 + \ldots$ ✓ $S_n = 4k$ ✓ substitution into correct formula ✓ n = 56 ✓ answer (5) ✓ $11 + 14 + 17 + \ldots$ ✓ $S_n = 4k$ ✓ substitution into correct formula ✓ n = 56 ✓ answer (5)
2.4.1	$4; \frac{1}{36}$	✓ answer (1)

2.4.2	$4; 4; 4; \ldots$ 13 terms $\frac{3}{4}; \frac{1}{4}; \frac{1}{12}; \ldots$ 12 terms $S_{13} = 13(4)$ $= 52$ $S_{12} = \frac{a(1-r^n)}{1-r}$ $= \frac{\frac{3}{4}\left(1-\left(\frac{1}{3}\right)^{12}\right)}{1-\frac{1}{3}}$ $= 1,12$ $S_{25} = S_{13} + S_{12}$ $= 52 + 1,12$ $= 53,12$	✓ n = 13 ✓ $S_{13} = 52$ ✓ n = 12 ✓ substitution into correct formula ✓ $S_{12} = 1,12$ ✓ answer (6) **[23]**

QUESTION 3

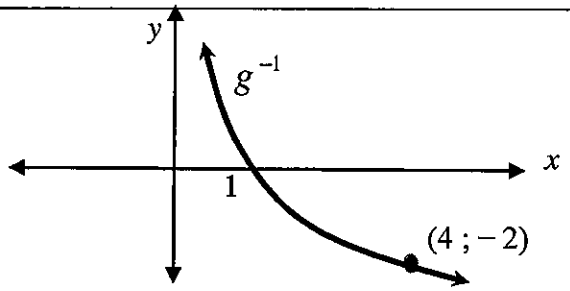
3.1	$y = \frac{-3}{0-2} + 1$ $= \frac{3}{2} + 1$ $= 2,5$ or $y = \frac{5}{2}$ $\therefore (0; 2,5)$ or $\left(0; \frac{5}{2}\right)$	✓ $x = 0$ ✓ $y = 2,5$ or $y = \frac{5}{2}$ (2)
3.2	$0 = \frac{-3}{x-2} + 1$ $-1 = \frac{-3}{x-2}$ $x - 2 = 3$ $x = 5$ $\therefore (5; 0)$	✓ $y = 0$ ✓ $x = 5$ (2)

3.3		✓ shape ✓ both intercepts ✓ both asymptotes (3)
3.4	$y \in R$; $y \neq 1$ **OR** $y < 1$ or $y > 1$ **OR** $y \in (-\infty; 1) \cup y \in (1; \infty)$	✓ $y \in R$ ✓ $y \neq 1$ (2) ✓ $y < 1$; ✓ $y > 1$ (2) ✓ $y \in (-\infty; 1)$ ✓ $y \in (1; \infty)$ (2)
3.5	$h(x) = \frac{-3}{x-5} - 3$	✓ $\frac{-3}{x-5}$ ✓ -3 (2)
3.6	From the graph of h:  $5 < x \leq 8$ or $x \in (5; 8]$ **OR** From translations: $h(x) \leq -4 \therefore f(x) \leq 0$ (4 units up) If $f(x) \leq 0$, then $2 < x \leq 5$ $\therefore$ for $h(x)$: $5 < x \leq 8$ (3 units to the right)	✓ (8; –4) ✓ $5 < x$ ✓ $x \leq 8$ (3) ✓ $f(x) \leq 0$ ✓ $f(x)$: $2 < x \leq 5$ ✓ $h(x)$: $5 < x \leq 8$ (3)

3.7	$k(x) = \dfrac{3x-5}{x-1}$ By dividing $x-1$ into $3x-5$: $k(x) = \dfrac{-2}{x-1} + 3$ $\therefore$ The asymptotes are: $x = 1$ and $y = 3$ **OR** $k(x) = \dfrac{3x-5}{x-1}$ $k(x) = \dfrac{3(x-1)-2}{x-1}$ $k(x) = 3 - \dfrac{2}{x-1}$ $\therefore$ The asymptotes are: $x = 1$ and $y = 3$	✓ $k(x) = \dfrac{-2}{x-1} + 3$ ✓ $x = 1$ ✓ $y = 3$ (3) ✓ $k(x) = \dfrac{-2}{x-1} + 3$ ✓ $x = 1$ ✓ $y = 3$ (3) **[17]**

QUESTION 4

4.1	$x = -1$	✓ $x = -1$ (1)
4.2	$(-1; -8)$	✓ answer (1)
4.3	$2(x+1)^2 - 8 = 0$ $2(x+1)^2 = 8$ $(x+1)^2 = 4$ $x + 1 = \pm 2$ $x = 1$ or $x = -3$ $\therefore$ PQ = 1 + 3 = 4 units **OR** $2(x^2 + 2x + 1) - 8 = 0$ $2x^2 + 4x + 2 - 8 = 0$ $2x^2 + 4x - 6 = 0$ $x^2 + 2x - 3 = 0$ $(x+3)(x-1) = 0$ $x = 1$ or $x = -3$ $\therefore$ PQ = 1 + 3 = 4 units	✓ $y = 0$ ✓ $(x+1)^2 = 4$ ✓ $x + 1 = \pm 2$ ✓ PQ = 4 units (4) ✓ $y = 0$ ✓ standard form ✓ factors ✓ PQ = 4 units (4)

4.4	$k(x) = 2(-x+1)^2 - 8$ $= 2(x^2 - 2x + 1) - 8$ $= 2x^2 - 4x + 2 - 8$ $= 2x^2 - 4x - 6$ **OR** $k(x) = 2(-x)^2 + 4(-x) - 6$ $= 2x^2 - 4x - 6$ **OR** $k(x) = 2(x-1)^2 - 8$ $= 2(x^2 - 2x + 1) - 8$ $= 2x^2 - 4x + 2 - 8$ $= 2x^2 - 4x - 6$	✓ substituting x by $-x$ ✓ simplification $(x^2 - 2x + 1)$ ✓ answer $(2x^2 - 4x - 6)$ (3) ✓ substituting x by $-x$ ✓✓ answer (3) ✓ substituting $(x + 1)$ by $(x - 1)$ ✓ simplification $(x^2 - 2x + 1)$ ✓ answer $(2x^2 - 4x - 6)$ (3)
4.5	$x = \left(\frac{1}{2}\right)^y$ $y = \log_{\frac{1}{2}} x$ **OR** $y = -\log_2 x$ **OR** $y = \log_2 \frac{1}{x}$	✓ answer (1) ✓ answer (1) ✓ answer (1)
4.6		✓ shape ✓ x-intercept ✓ point $(4 ; -2)$ or any other point (3)
4.7.1	$0 < x \leq 4$ **OR** $x \in (0; 4]$	✓ $0 < x$ ✓ $x \leq 4$ (2) ✓✓ answer (2)
4.7.2	x-intercepts: $x = -3$ and $x = 1$ If $x < 0$ then $f(x) > 0$: $\therefore\ x < -3$ or if $x > 0$ then $f(x) < 0$: $\therefore\ 0 < x < 1$	✓✓ $x < -3$ ✓✓ $0 < x < 1$ (4)

	OR $x \in (0;1) \cup (-\infty;-3)$	✓✓ $(0;1)$ ✓✓ $(-\infty;-3)$ (4) **[19]**

QUESTION 5

5.1	$0{,}10 \times R980\,000$ $= R98\,000$ $\therefore$ Loan $= 980\,000 - 98\,000$ $= R882\,000$ **OR** Loan $= R980\,000 - 0{,}10\,(R980\,000)$ $= R882\,000$ **OR** Loan $= 0{,}9 \times R980\,000$ $= R882\,000$	✓ $0{,}10 \times R980\,000$ ✓ $R882\,000$ (2) ✓ $0{,}10 \times R980\,000$ ✓ $R882\,000$ (2) ✓ $0{,}9 \times R980\,000$ ✓ $R882\,000$ (2)
5.2	$P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $882\,000 = \frac{10\,000\left[1-\left(1+\frac{0{,}11}{12}\right)^{-n}\right]}{\frac{0{,}11}{12}}$ $\frac{1617}{2000} = 1-\left(1+\frac{0{,}11}{12}\right)^{-n}$ $\left(1+\frac{0{,}11}{12}\right)^{-n} = \frac{383}{2000}$ $-n = \log_{\left(1+\frac{0{,}11}{12}\right)}\frac{383}{2000}$ $-n = -181{,}14$ $n = 181{,}14$ $\therefore$ It takes 182 months **OR**	✓ $i = \frac{0{,}11}{12}$ ✓ substitution into the correct formula ✓ $\left(1+\frac{0{,}11}{12}\right)^{-n} = \frac{383}{2000}$ ✓ introducing logs $-n = \log_{\left(1+\frac{0{,}11}{12}\right)}\frac{383}{2\,000}$ or $-n = \log_{\left(\frac{1211}{1200}\right)}0{,}1915$ or $-n = \frac{\log 0{,}1915}{\log 1{,}00916667}$ ✓ $n = 181{,}14$ ✓ 182 months (6)

	$P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $882\,000 = \frac{10\,000\left[1-\left(1+\frac{0,11}{12}\right)^{-n}\right]}{\frac{0,11}{12}}$ $\frac{383}{2000} = \left(1+\frac{0,11}{12}\right)^{-n}$ $\log\left(\frac{383}{2000}\right) = \log\left(1+\frac{0,11}{12}\right)^{-n}$ $\log\left(\frac{383}{2000}\right) = -n\log\left(1+\frac{0,11}{12}\right)$ $-n = -181,14$ $n = 181,14$ ∴ It takes 182 months	✓ $i = \frac{0,11}{12}$ ✓ substitution into the correct formula ✓ $\frac{383}{2000} = \left(1+\frac{0,11}{12}\right)^{-n}$ ✓ introducing logs $-n = \frac{\log\left(\frac{383}{2000}\right)}{\log\left(1+\frac{0,11}{12}\right)}$ or $-n = \frac{\log 0,1915}{\log 1,00916667}$ ✓ $n = 181,14$ ✓ 182 months (6)
5.3	$n = 181,1379918 - 90$ $= 91,1379918$ $P_v = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $P_v = \frac{10\,000\left[1-\left(1+\frac{0,11}{12}\right)^{-91,1379918}\right]}{\frac{0,11}{12}}$ $= R615\,991,70$ **OR**	✓ n = 91,1379918 ✓ substitution into the correct formula ✓ answer (3)

	$A = P(1+i)^n$ $= 882\,000\left(1+\frac{0,11}{12}\right)^{90}$ $A = R2\,005\,069,01$ $F_v = \frac{x\left[(1+i)^n - 1\right]}{i}$ $= \frac{10\,000\left[\left(1+\frac{0,11}{12}\right)^{90} - 1\right]}{\frac{0,11}{12}}$ $F_v = R1\,389\,077,31$ Outstanding balance after 90 instalments: $= R2\,005\,069,01 - R1\,389\,077,31$ $= R615\,991,70$	✓ substitution into the correct formula (or 2 005 069,01) ✓ substitution into the correct formula (or 1 389 077,31) ✓ answer (R615 991,70) (3)
5.4	$A = P(1+i)^n$ $= 615\,991,70\left(1+\frac{0,11}{12}\right)^5$ $=644\,747,02$ $P_v = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $644\,747,02 = \frac{x\left[1-\left(1+\frac{0,11}{12}\right)^{-87}\right]}{\frac{0,11}{12}}$ $x = R10\,786,84$	✓ substitution into the correct formula ✓ answer ✓ substitution into the correct formula ✓ n = 182-95 = 87 ✓ answer (5) **[16]**

QUESTION 6

6.1

$f(x) = \frac{3}{x}$

$f(x+h) = \frac{3}{x+h}$ ✓ subst $(x+h)$ in $f(x)$

$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$

$= \lim_{h\to 0} \frac{\frac{3}{x+h} - \frac{3}{x}}{h}$ ✓ substitution into formula

$= \lim_{h\to 0} \frac{3x - 3(x+h)}{x(x+h)} \times \frac{1}{h}$

$= \lim_{h\to 0} \frac{3x - 3x - 3h}{x(x+h)} \times \frac{1}{h}$ ✓ $\frac{3x-3x-3h}{x(x+h)}$

$= \lim_{h\to 0} \frac{-3h}{x(x+h)} \times \frac{1}{h}$

$= \lim_{h\to 0} \frac{-3}{x(x+h)}$ ✓ simplification

$= \frac{-3}{x^2}$ ✓ answer

(5)

OR

$f(x) = \frac{3}{x}$

$f(x+h) = \frac{3}{x+h}$ ✓ subst $(x+h)$ in $f(x)$

$f(x+h) - f(x) = \frac{3}{x+h} - \frac{3}{x}$

$= \frac{3x - 3x - 3h}{x(x+h)}$ ✓ $\frac{3x-3x-3h}{x(x+h)}$

$= \frac{-3h}{x(x+h)}$

$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$

$= \lim_{h\to 0} \frac{-3h}{x(x+h)} \times \frac{1}{h}$ ✓ substitution into formula

$= \lim_{h\to 0} \frac{-3}{x(x+h)}$ ✓ simplification

$= \frac{-3}{x^2}$ ✓ answer

(5)

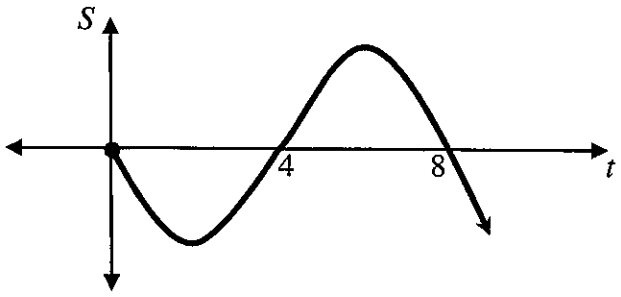
6.2.1	$y = \pi^3 x - x^{\frac{1}{3}}$ $\frac{dy}{dx} = \pi^3 - \frac{1}{3}x^{-\frac{2}{3}}$	✓ $-x^{\frac{1}{3}}$ ✓ π^3 ✓ $-\frac{1}{3}x^{-\frac{2}{3}}$ (3)
6.2.2	$y = \frac{7}{4}x^4 - \frac{3}{4}$ $\frac{dy}{dx} = 7x^3$ **OR** $y = \frac{x(7x^4 - 3)}{4x}$ $= \frac{1}{4}(7x^4 - 3)$ $\frac{dy}{dx} = \frac{1}{4}(7(4)x^3 - 0)$ $= 7x^3$	✓ $y = \frac{7}{4}x^4 - \frac{3}{4}$ ✓ $\frac{dy}{dx} = 7x^3$ (2) ✓ $y = \frac{1}{4}(7x^4 - 3)$ ✓ $\frac{dy}{dx} = 7x^3$ (2) **[10]**

QUESTION 7

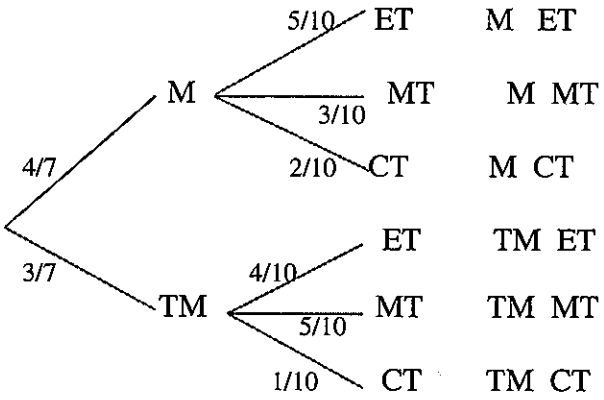
7.1	$f(x) = x^3 + px^2 + qx - 12$ $36 = (-4)^3 + p(-4)^2 + q(-4) - 12$ $36 = -64 + 16p - 4q - 12$ $112 = 16p - 4q$ $28 = 4p - q$ .....(1) $f'(x) = 3x^2 + 2px + q$ $f'(-4) = 3(-4)^2 + 2p(-4) + q$ $0 = 48 - 8p + q$ $-48 = -8p + q$ .....(2) $28 = 4p - q$ .....(1) (1) + (2): $-20 = -4p$ $5 = p$ (1): $28 = 4(5) - q$ $q = -8$	✓ substitution of $(-4; 36)$ into $f(x)$ ✓ $28 = 4p - q$ ✓ $f'(x) = 3x^2 + 2px + q$ ✓ $f'(-4) = 0$ ✓ $48 = 8p - q$ OR $-48 = -8p + q$ ✓ simplification (6)

7.2	$f(x) = x^3 + 5x^2 - 8x - 12$ $f(x) = (x+1)(x^2 + 4x - 12)$ *(long division method)* $0 = (x+1)(x^2 + 4x - 12)$ $0 = (x+1)(x+6)(x-2)$ $x = -1$ or $x = -6$ or $x = 2$ Coordinates of other x-intercepts are: $(-6; 0)$ or $(2; 0)$ **OR** $(x+1)(x^2 + bx - 12) = x^3 + 5x^2 - 8x - 12$ $bx - 12x = -8x$ $b - 12 = -8$ $\therefore b = 4$ $x^2 + 4x - 12 = 0$ $(x+6)(x-2) = 0$ $x = -6$ or $x = 2$ Coordinates of other x-intercepts are: $(-6; 0)$ or $(2; 0)$	✓ $(x+1)(x^2+4x-12)$ ✓ factors ✓ $(-6; 0)$ ✓ $(2; 0)$ (4) ✓ b = 4 ✓ factors $(x+6)(x-2)$ ✓ $(-6; 0)$ ✓ $(2; 0)$ (4)
7.3	$f'(x) = 3x^2 + 10x - 8$ $f'(1) = 3(1)^2 + 10(1) - 8$ $= 5$ $y - y_1 = m(x - x_1)$ $y + 14 = 5(x-1)$ $y = 5x - 19$ **OR** $f'(x) = 3x^2 + 10x - 8$ $f'(1) = 3(1)^2 + 10(1) - 8$ $= 5$ $y = mx + c$ $-14 = 5(1) + c$ $-19 = c$ $\therefore y = 5x - 19$	✓ $f'(x) = 3x^2 + 10x - 8$ ✓ $f'(1) = 5$ ✓ substitution ✓ answer (4) ✓ $f'(x) = 3x^2 + 10x - 8$ ✓ $f'(1) = 5$ ✓ substitution ✓ answer (4)
7.4	$0 < k \leq 7$	✓ $0 < k$ ✓ $k \leq 7$ (2) **[16]**

QUESTION 8

8.1	$S(t) = -t^3 + 12t^2 - 32t$ $0 = -t^3 + 12t^2 - 32t$ $0 = t^3 - 12t^2 + 32t$ $0 = t(t^2 - 12t + 32)$ $0 = t(t-4)(t-8)$ $t = 0$ or $t = 4$ or $t = 8$ $\therefore$ After 8 hours  	✓ $0=t(t^2-12t+32)$ ✓ factors ✓ $t = 8$ (3)
8.2	$S'(t) = -3t^2 + 24t - 32$ $0 = -3t^2 + 24t - 32$ $0 = 3t^2 - 24t + 32$ $t = \frac{24 \pm \sqrt{(-24)^2 - 4(3)(32)}}{2(3)}$ or $t = \frac{-24 \pm \sqrt{(24)^2 - 4(-3)(-32)}}{2(-3)}$ $t = 1{,}69$ *hours* or $t = 6{,}31$ *hours* $S(1{,}69) = -(1{,}69)^3 + 12(1{,}69)^2 - 32(1{,}69)$ $= -24{,}63$ *km* $S(6{,}31) = -(6{,}31)^3 + 12(6{,}31)^2 - 32(6{,}31)$ $= 24{,}63$ *km* $\therefore$ Distance is 24,63 *km*	✓ $S'(t)=-3t^2+24t-32$ ✓ $S'(t)=0$ ✓ substitution into the formula ✓ t = 1,69 or t = 6,31 ✓ 24,63 *km* (5)
8.3	$S''(t) = -6t + 24$ $0 = -6t + 24$ $6t = 24$ $\therefore t = 4$ $S'(4) = -3(4)^2 + 24(4) - 32$ $= 16$ *km / h*	✓ $S''(t) = -6t+24$ ✓ $S''(t)=0$ ✓ $t = 4$ ✓ 16 *km/h* (4) **[12]**

QUESTION 9

9.1		First event: ✓ M 4/7 ; TM 3/7 Second event: ✓ M: ET 5/10; MT 3/10; CT 2/10 ✓ TM: ET 4/10; MT 5/10; CT 1/10 ✓ Outcomes (4)
9.2.1	$P(\text{TM and MT}) = \frac{3}{7} \cdot \frac{5}{10}$ $= \frac{3}{14}$	✓ $\frac{3}{7} \cdot \frac{5}{10}$ ✓ $\frac{3}{14}$ or 0,21 (2)
9.2.2	$P(\text{ET}) = \frac{4}{7} \cdot \frac{5}{10} + \frac{3}{7} \cdot \frac{4}{10}$ $= \frac{16}{35} = 0,46$	✓ $\frac{4}{7} \cdot \frac{5}{10}$ ✓ $\frac{3}{7} \cdot \frac{4}{10}$ ✓ $\frac{16}{35}$ or 0,46 (3) **[9]**

QUESTION 10

10.1.1	$10^6 = 1\,000\,000$	✓ 10^6 or 1 000 000 (1)
10.1.2	(8)(7)(6)(5) = 1680 **OR** $_8P_4$ = 1680	✓ (8)(7)(6)(5) ✓ 1680 (2) ✓ $_8P_4$ ✓ 1680 (2)
10.2	10! – (9!)(2!) = 3 628 800 – 725 760 = 2 903 040	✓ 10! ✓ (9!)(2!) ✓ answer (3) **[6]**
		TOTAL: 150

COGNITIVE GRID

Questions	Levels				Topics					
	L1	L2	L3	L4	Alg	Pat	Func	Fin	Diff	Prob
1.1.1	2				2					
1.1.2		4			4					
1.1.3	3				3					
1.1.4			4		4					
1.2		6			6					
1.3				3	3					
2.1.1	1					1				
2.1.2		1				1				
2.1.3		4				4				
2.2.1	2					2				
2.2.2	3					3				
2.3				5		5				
2.4.1	1					1				
2.4.2			6			6				
3.1	2						2			
3.2		2					2			
3.3	3						3			
3.4	2						2			
3.5	2						2			
3.6				3			3			
3.7			3				3			
4.1	1						1			
4.2	1						1			
4.3		4					4			
4.4		3					3			
4.5	1						1			
4.6	3						3			
4.7.1				2			2			
4.7.2				4			4			
5.1	2							2		
5.2			6					6		
5.3			3					3		
5.4			5					5		
6.1			5						5	
6.2.1		3							3	
6.2.2		2							2	
7.1			6						6	
7.2		4							4	
7.3			4						4	
7.4				2					2	
8.1		3							3	
8.2		5							5	
8.3			4						4	

Question	Levels				Topics					
	L1	L2	L3	L4	Alg	Pat	Func	Fin	Diff	Prob
9.1		4								4
9.2.1		2								2
9.2.2		3								3
10.1.1	1									1
10.1.2		2								2
10.2				3						3
Policy:										
Marks	**30**	**52,5**	**45**	**22,5**	**25**	**25**	**35**	**15**	**35**	**15**
%	**20**	**35**	**30**	**15**						
Real:										
Marks	30	52	46	22	22	23	36	16	38	15
%	20	35	30	15						