Memo

A.M. P1

Nov. 2016 Exam

Q 1 a)

1) $(2x+1)^2 = 4$

$2x+1 = \pm 2$ ✓M

$2x = -1 \pm 2$ ✓A

$x = \frac{-3}{2}$ ✓A OR $+\frac{1}{2}$ ✓A

$4x^2 + 4x + 1 - 4 = 0$ } ✓M

$4x^2 + 4x - 3 = 0$

$(2x+3)(2x-1) = 0$ ✓A

$\therefore x = -\frac{3}{2}$ ✓A OR $x = \frac{1}{2}$ ✓A

(3)

2) $-x + 5 - 2x^2 = 0$

$2x^2 + x - 5 = 0$

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-5)}}{2(2)}$$ ✓M

$$= \frac{-1 \pm \sqrt{1 + 40}}{4}$$

$$= \frac{-1 \pm \sqrt{41}}{4}$$ ✓A

$x = 1,4$ ✓A OR $x = -1,9$ ✓A (3)

3) $\sqrt{2x-1} = (x-2)$

$2x - 1 = x^2 - 4x + 4$ ✓M

$0 = x^2 - 6x + 5$

$0 = (x-5)(x-1)$ ✓A

$x = 5$ ✓A OR $x = 1$ ✓A N.V

Check: (4)

4) $3^{x^2-1} = \frac{27}{3^x}$

$3^{x^2-1} = 3^{-3x-1}$ ✓m

$x^2 - 1 = -3x - 1$ ✓m

$x^2 + 3x = 0$

$x(x+3) = 0$ ✓A

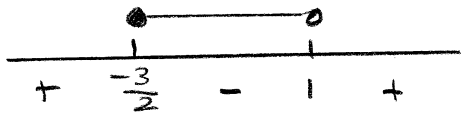
$x = 0$ ✓A or $x = -3$ ✓A

4) $(x+2)(2x-3) \leq -3$

$2x^2 - 3x + 4x - 6 + 3 \leq 0$ ✓m

$2x^2 + x - 3 \leq 0$

$(2x + 3)(x - 1) \leq 0$ ✓A



✓m

$x \in \left[-\frac{3}{2}, 1\right]$ ✓A (4)

5) $-4x^2 - 12x + 8 = 0$

$x^2 + 3x - 2 = 0$

$x^2 + 3x + (3/2)^2 = 2 + (3/2)^2$ ✓M ✓A ✓A

$(x + \frac{3}{2})^2 = 2 + \frac{9}{4}$ ✓A

$(x + \frac{3}{2})^2 = \frac{17}{4}$ ✓A

$x + \frac{3}{2} = \pm\sqrt{\frac{17}{4}}$ ✓A

$x = \frac{-3 \pm \sqrt{17}}{2}$ ✓A (5)

6) $3^{2x+2} + 1 = 10.3^x$

$3^{2x}.3^2 - 10.3^x + 1 = 0$

$k = 3^x$

$k^2 = 3^{2x}$

$9k^2 - 10k + 1 = 0$ ✓M

$(9k - 1)(k - 1) = 0$ ✓A

$k = \frac{1}{9}$ ✓m OR $k = 1$ ✓m

$3^x = 3^{-2}$ $3^x = 3^0$

$x = -2$ ✓A $x = 0$ ✓A (5)

b) 1) $x + y = 2$ $y + 1 = \frac{-3}{x-1}$

$x = 2 - y$ ✓m

✓m $(y+1)(x-1) + 3 = 0$

$(y+1)(2-y-1) + 3 = 0$

$(y+1)(-y+1) + 3 = 0$

$-(y+1)(y-1) + 3 = 0$

$y^2 - 1 - 3 = 0$ ✓M

$y^2 - 4 = 0$ ✓A

$y = \pm 2$ ✓A

$y = 2$ $y = -2$

$x = 2 - 2$ $x = 2 - (-2)$

$x = 0$ ✓A $x = 4$ ✓A (6)

$(0, 2)$ $(4; -2)$

2) $(x, y) = (0, 2)$ $\therefore \left(\frac{1}{0} + \frac{1}{2}\right)$ undefined ✓A

$(x, y) = (4; -2)$ $\left(\frac{1}{4} + \frac{1}{-2}\right)$

$= -\frac{1}{4}$ ✓A (2)

Q2 $f(x) = \frac{5}{x}$

a) $y = \frac{5}{x} + 4$ ✓

b) $y = \frac{5}{x+2} - 3$ ✓✓

c) $y = -\frac{2}{x}$ ✓ $\left(\frac{2}{-x} = y\right)$ (3)

Q3

a) $A = P(1 - in)$

$0 = P(1 - 12{,}5\%\, n)$ ✓A

$0 = 1 - 12{,}5\%\, n$

$12{,}5\%\, n = 1$

$n = \frac{1}{12{,}5\%}$ ✓m

$n = 8$ yrs ✓A (3)

b) $A = 35700\left(1 + \frac{7{,}95\%}{12}\right)^{5\times 12}$ ✓m

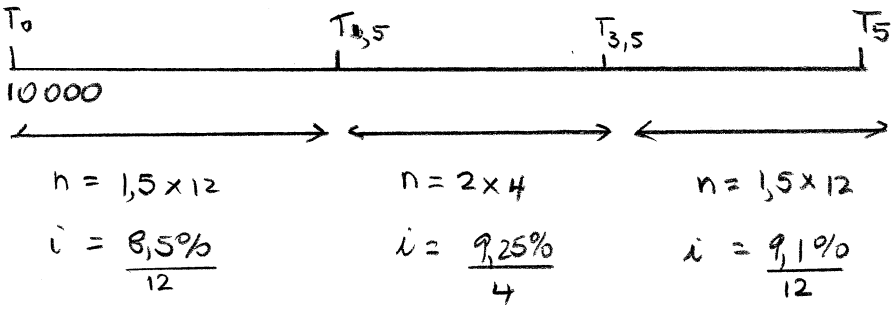
$= 53055{,}64\ldots$ Ⓐ ✓A

Interest = Ⓐ $- 35700$ ✓M

= R17355,66 ✓A (4) (3)

Q3

c)



1) $A = 10000\left(1+\frac{8,5\%}{12}\right)^{1,5\times12}\left(1+\frac{9,25\%}{4}\right)^{2\times4}\left(1+\frac{9,1\%}{12}\right)^{1,5\times12}$ ✓ ✓ ✓

$= \underline{R\ 15619,40}$ ✓A (4)

2) $A = P(1+i)^n$

$15619,40 = 10000(1+i)^5$ ✓m (subst) ✓A

$1,56194 = (1+i)^5$

$1,09... = 1+i$

$0,09... = i$

$\underline{i = 9,3\%}$ ✓A effective (3)

Q 4

(a)

(1) $\left(5+\frac{1}{16}\right)^{\frac{3}{4}} - (x-3)^0$

$= \left(\frac{81}{16}\right)^{\frac{3}{4}} - 1$

$= {}^{M}\checkmark\left(\frac{34}{24}\right)^{\frac{3}{4}} - 1$

$= \frac{3^3}{2^3}$ ✓A − 1 ✓A

$= \frac{27}{8} - \frac{1}{1}$

$= \frac{19}{8}$ ✓A (3)

(2) $\left(\sqrt{98} - \sqrt{50}\right)^2$

$= \left(7\sqrt{2} - 5\sqrt{2}\right)^2$ m

$= \left(2\sqrt{2}\right)^2$ ✓A

$= 4(2)$ ✓A

$= 8$ ✓A (3)

b)

1) $\frac{3a^2+27}{2a+6} \div \frac{a^4-81}{6a-18}$

$= \frac{3(a^2+9)}{2(a+3)} \times \frac{6(a-3)}{(a^2-9)(a^2+9)}$ ✓

$= \frac{3}{2(a+3)} \times \frac{6(a-3)}{(a+3)(a-3)}$

$= \frac{9}{(a+3)^2}$ ✓A (4)

4 b)

2) $\dfrac{pq^{-1} - p^{-1}q}{q^{-1} - p^{-1}}$

$= (pq^{-1} - p^{-1}q) \div (q^{-1} - p^{-1})$

$= \left(\dfrac{p}{q} - \dfrac{q}{p}\right) \div \left(\dfrac{1}{q} - \dfrac{1}{p}\right)$ ↵ m

$= \left(\dfrac{p^2 - q^2}{pq}\right)$ ↵ $\div \left(\dfrac{p-q}{pq}\right)$ ↵ m

$= \dfrac{(p-q)(p+q)}{pq} \times \dfrac{pq}{(p-q)}$

$= p+q$ ← 17

(4)

Q 5)

	1	2	5	10	17
d_1	1	3	5	7	
d_2	2	2	2		

$2a = 2$ ✓m
$a = 1$ ✓A

$3a + b = 1$
$3 + b = 1$ ✓m
$b = -2$ ✓A

$a + b + c = 1$
$1 - 2 + c = 1$ ✓m
$c = 2$ ✓A

$\therefore T_n = 1n^2 - 2n + 2$ ✓A (5)

OR

$$T_n = a + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$$

$$= 1 + (n-1)1 + \frac{(n-1)(n-2)\cancel{2}}{\cancel{2}}$$ ✓M ✓A subs

$$= 1 + n - 1 + n^2 - 3n + 2$$ ✓M ✓A

$T_n = n^2 - 2n + 2$ ✓A (5)

(2) $T_{50} = 50^2 - 2(50) + 2$ ✓m

$= 2402$ ✓A (2)

(3) $T_n = 122$

$n^2 - 2n + 2 = 122$

$n^2 - 2n - 120 = 0$ ✓m

$(n - 12)(n + 10) = 0$

$n = 12$ OR $n = -10$ N.V

Just look!

R_1	1
R_2	4
R_3	9
R_{11}	121

✓m

∴ 121 will be on 11th ✓A row at end (2)

(4)

R_1	R_2	R_3	R_4	R_n
1	3	5	7	$(2n - 1)$ ✓A

∴ $R_{112} = 2(112) - 1$ ✓m

$= 223$ numbers ✓A (3)

Q6 a) $f(x) = y = ax^2 + bx + c$

$y = a(x+3)(x-1)$ ✓m ✓A sub $(0,3)$

$+3 = a(3)(-1)$

$+3 = -3a$

$a = -1$ ✓A

$\therefore \quad y = -1(x+3)(x-1)$ ✓M

$= -(x^2 + 2x - 3)$

$y = -x^2 - 2x + 3$ (4)

b) D:

$x = \frac{-b}{2a}$ ✓m

$= \frac{-(-2)}{2(-1)}$

$= -1$

$y = -(-1)^2 - 2(-1) + 3$ ✓m

$= -1 + 2 + 3$

$= 4$

$D(-1;4)$ ✓A

$m_{AD} = \frac{4-0}{-1+3}$

$= \frac{4}{2}$

$= 2$ ✓A

Eqt $\perp$ AD $\quad \therefore \quad m = -\frac{1}{2}$ $\quad D(-1,4)$

$y - 4 = -\frac{1}{2}(x+1)$ ✓M

$y = -\frac{1}{2}x - \frac{1}{2} + 4$

$y = -\frac{1}{2}x + 3\frac{1}{2}$ ✓A (6)

c) $x \in (-1, \infty)$ ✓ ✓ $[x > -1]$ (1)

d) $y \in (-\infty, 4]$ ✓ ✓ (1)

Q7 a)

1) $2x^2 + qr = 0$

$2(-1)^2 + qr = 0$ ✓m

$qr = -2$ ✓A (2)

2) $2x^2 + qr = 0$ $\quad qr \in \{-2; -1; 0; 1; 2\}$

$a = 2 \quad b = 0 \quad c = qr$

$\Delta = b^2 - 4ac$

$= -4(2)(qr)$

$= -8qr$ ✓A

Rat and Different Unequal $\quad \Delta > 0$ and Δ is perf sq

$-8qr > 0$

✓m $\quad qr < 0$ $\quad -8qr$ perf. sq

$\therefore$ $qr = -2$ ✓ $\quad -8qr = 16$ perf sq

$qr = -1 \quad -8qr = 8$ not perf

$\therefore qr = -2$ ✓A (3)

2) Irrational $\therefore$ $\Delta > 0$ and ✓m Δ not perfect sq

$\therefore qr < 0$ $\quad \therefore qr = -1$ ✓A (2)

Q7 b)

$x + 4p = \frac{20}{x}$ $\qquad x = p$

$p + 4p = \frac{20}{p}$ ✓m

$5p^2 = 20$ } A✓

$p^2 = 4$ }

$p = \pm 2$ ✓A (3)

Q8

a) $A = 15$ ✓A

$B = 25$ ✓A (2)

b) i) $P(\text{short}, B') = \frac{5}{75}$

$= \frac{1}{15}$ ✓A (1)

ii) $P(\text{tall}, B) = \frac{40}{60}$

$= \frac{2}{3}$ ✓A (1)

c) $P(T \text{ and } B) = \frac{40}{75}$ ✓

$= \frac{8}{15}$

$= 0,5\dot{3}$

$P(T) \times P(B) = \frac{60}{75}$ ✓ $\times \frac{50}{75}$ ✓

$= \frac{8}{15}$

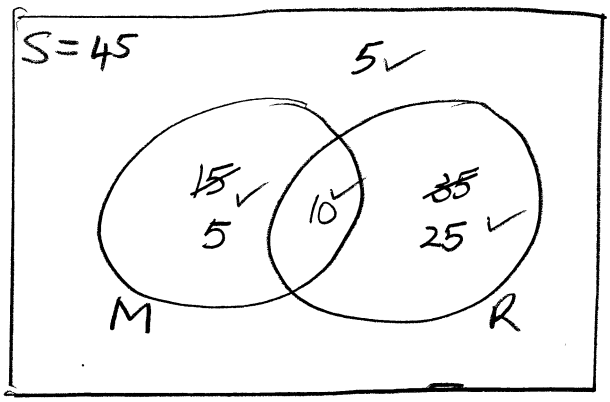
$= 0,5\dot{3}$

$\therefore P(T \text{ and } B) = P(T) \times P(B)$ } ✓ (4)

$\therefore$ Indep }

Q9

a)



(4)

b)

1) $P(m) = \frac{5}{45} = \frac{1}{9}$ (2)

2) $P(m') = \frac{30}{45} = \frac{2}{3}$ (2)

−1 if not lowest form

3) $P(M \text{ and } R) = \frac{25}{45} = \frac{5}{9}$

4) $P(M' \text{ or } R) = \frac{35}{45} = \frac{7}{9}$

(8)

Q 10

a) 1)

T_1	T_2	T_3	T_n
1	2	4	
1	1×2	$1\times2\times2$	
1	1×2	1×2^2	$1\times2^{n-1}$ ✓m

$T_n = 1.2^{n-1}$

$= 2^{n-1}$ ✓A (2)

2) $T_7 = 2^{7-1}$ ✓m

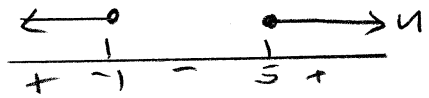
$= 2^6$

$= 64$ ✓A (2)

b) $(x-2)^2 - 9 \geq 0$ ✓A

$(x-2+3)(x-2-3) \geq 0$ ✓m

$(x+1)(x-5) \geq 0$



$\therefore x \in (-\infty, -1]$ ✓ OR $[5; \infty)$ ✓ (4)

c) $2^{2020} \times 5^{2016} = (2\times5)^{2016} \times 2^4$ ✓M ✓

$= (10)^{2012} \times 16$ ✓A ✓m

$= 16 \times 10^{2012}$ ✓A

$\therefore$ Sum digits $= 1+6+0+0+0+0\ldots$

$= 7$ ✓A (4)

d) $\left(\frac{2}{1}\right)^{T_1}\left(\frac{4}{3}\right)^{T_2}\left(\frac{5}{4}\right)^{T_3}\left(\frac{6}{5}\right)^{\checkmark m} \times \cdots \rightarrow \left(\frac{100}{95}\right)^{\checkmark A}$

98 kemo ∴ Rem
98 + 2 = 100

$= \frac{100}{2}$ ✓A

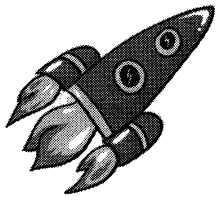
$= 50$ ✓A

(4)

MATHEMATICS PAPER I : ANSWER SHEET

NAME:_____

QUESTION 11 ANSWER IN THE SPACE PROVIDED

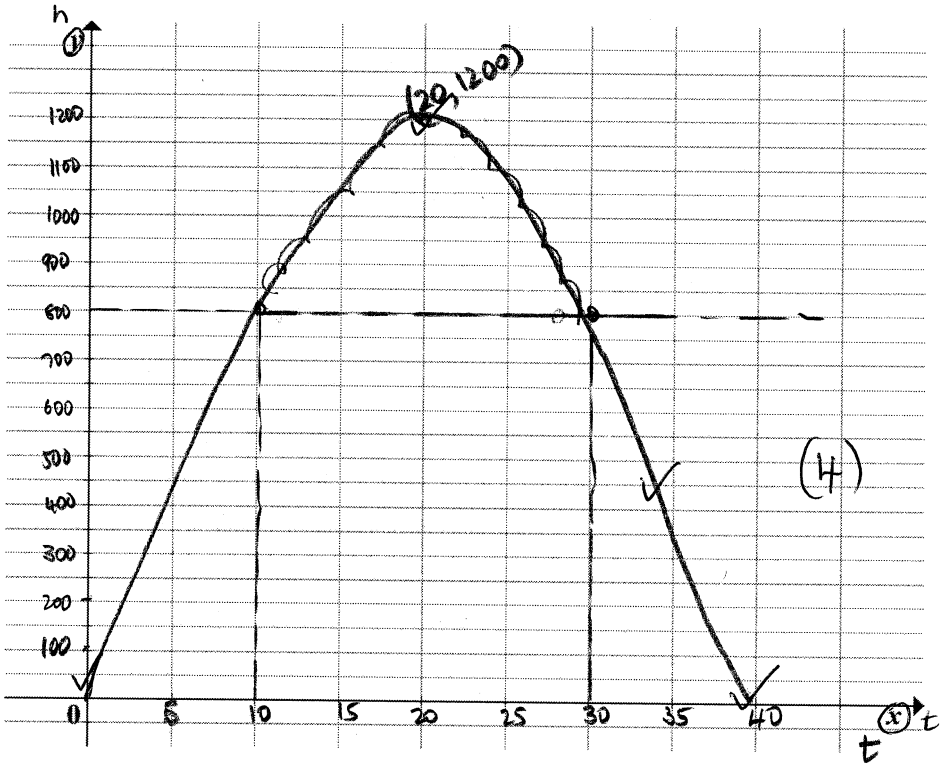


A rocket is fired upwards.

It follows a path that fits the equation $h(t) = 120t - 3t^2, \quad 0 \leq t \leq 40$

where h is the height in metres and t is the time in seconds from launch time.

(a) Sketch the graph of : $h(t) = 120t - 3t^2; \quad 0 \leq t \leq 40$ on the grid provided.
Clearly show all turning points and intercepts with axes. (4)



$h(t) = 120t - 3t^2 \qquad 0 \leq t \leq 40$

$120t - 3t^2 = 0$

$3t(40 - t) = 0$

$t = 0 \qquad 40 = t$

TP. $t = 20 \quad \therefore \quad h(20) = 120(20) - 3(20)^2$

$= 1200 \qquad (20; 1200)$

(b) **Use your graph** to determine:

(1) the time when the height of the rocket is zero. (1)

0 sec ✓ and 40 ✓ sec.

(2) the flight time of the rocket. (1)

40 sec ✓

(3) the maximum height of the rocket. (1)

20 m ✓

(4) how long after launching does the rocket reach its peak height. (1)

20 s ✓

(5) how long the rocket is above 800 *m*. (2)

$120t - 3t^2 = 800$

$3t^2 - 120t + 800 = 0$

$t \in (10; 30)$ ✓

$\therefore$ 20 ✓ sec.

(c) Explain why there is a restriction on t. (1)

does not go below grd. ✓

[11]

Q1

$$h(t) = 120t - 3t^2 \qquad 0 \le t \le 40$$

a) $h(t) = -3t^2 + 120t$

1) $a = -3$ ↶

2) $x = -b/2a$

$= \frac{-120}{-6}$

$= +20$

3) $y = -3(20)^2 + 120(20)$

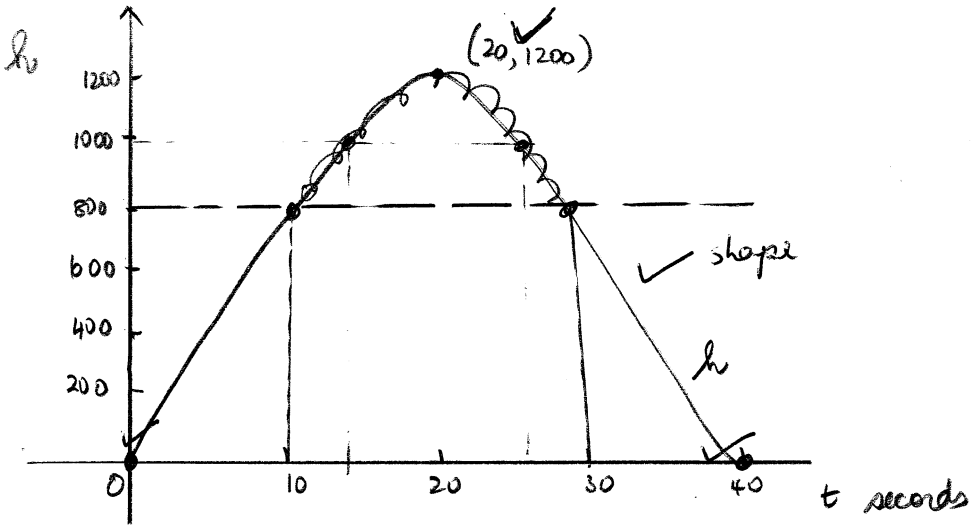
$= 1200$

4) T.P. $(20, 1200)$

5) Yint: $x = 0$ ∴ $(0,0)$

6) Xint: $y = 0$ $\quad 0 = -3t(t - 40)$

∴ $t = 0$ OR $t = 40$



(4)

b) 1) $h(t) = 0$ when $t = 0$ OR $t = 40$ seconds (1)

2) 40 seconds ✓ (1)

3) 1200 m ✓ (1)

4) 20 sec ✓ (1)

5) $t \in (10, 30)$ m

∴ 20 seconds (2)

c) does not go below ground (1)

Q12

a) $P(x) = -3(x-17)^2 + 560$

$\therefore$ 17 ✓A units must be sold

max profit is R560 ✓A (2)

b) x per day Budgets R1800

	Budgets	No BD	
Plan	x	y	1800
Actual	$x+10$	$y-2$	1800

1) $xy = 1800$

$y = \frac{1800}{x}$ ✓m

$(x+10)(y-2) = 1800$ ✓m

$(x+10)(\frac{1800}{x} - 2) = 1800$

$(x+10)(\frac{1800-2x}{x}) = 1800$

OR

$(x+10)(1800-2x) = 1800x$

$1800x - 2x^2 + 18000 - 20x = 1800x$

$2x^2 + 20x - 18000 = 0$ ✓A

$x^2 + 10x - 9000 = 0$

$(x-90)(x+100) = 0$ ✓A

$x = 90$ ✓A OR $x = -100$ N.V

i) $\therefore$ Budgeted R90 ✓A

ii) Actual exp R100 ✓A (6)

(2) $y = \frac{1800}{100}$ ✓m ✓CA

$= 18$ days

OR $y = \frac{1800}{90}$ ✓m

$= 20$

$\therefore$ Actual $20-2 = 18$ ✓CA (2)