# November 2015 Form 4

## Paper 1 memo.

### Section A [17]

**Q1** (a) $(x-3)(x+4) = 18$

$x^2 + x - 12 - 18 = 0$

$x^2 + x - 30 = 0$

$(x+6)(x-5) = 0$

$x = -6$ or $x = 5$ (3)

(b) $\frac{30}{x-2} - \frac{1}{2} = \frac{30}{x}$

CD $= x(x-2)$

$x \neq 0 \quad x \neq 2$

$60x - x(x-2) = 60(x-2)$

$60x - x^2 + 2x - 60x + 120 = 0$

$-x^2 + 2x + 120 = 0$

$x^2 - 2x - 120 = 0$

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

$x = 12$ or $-10$. (5)

(c) $2^{x-1} \cdot 8^{x+1} = 16^{-x-1}$

$2^{x-1} \cdot 2^{3x+3} = 2^{-4x-4}$

$x - 1 + 3x + 3 = -4x - 4$

$8x = -6$

$x = \frac{-3}{4}$ (4)

(d) $x = 2 - \sqrt{2x-5}$

$\sqrt{2x-5} = 2 - x$

$2x - 5 = 4 - 4x + x^2$

$x^2 - 6x + 9 = 0$

$(x-3)^2 = 0$

$x = 3.$

check rhs $= 2 - \sqrt{6-5}$

$\neq 3$

no solution. (5)

### [17]

**Q2** (a) $\frac{b^2 - 5b + 6}{b+2}$

(1) undefined if $b = -2$ (1)

(2) $b^2 - 5b + 6 = 0$

$(b-3)(b-2) = 0$

$b = 3$ or $2$ (2)

(b) $kx^2 - 7x + 4 = 0.$

Sub $x = 1$

$k - 7 + 4 = 0$

$k = 3$

$\therefore 3x^2 - 7x + 4 = 0$

$(3x-4)(x-1) = 0$

$x = \frac{4}{3}$ or other root. (4)

(c) $x - 2y = 1$ (1) $x^2 + y^2 = 29$ (2)

$x = 1 + 2y$. Sub into (2)

$(2y+1)^2 + y^2 - 29 = 0$

$4y^2 + 4y + 1 + y^2 - 29 = 0.$

$5y^2 + 4y - 28 = 0.$

$(5y+14)(y-2)$

$y = \frac{-14}{5}$ or $y = 2$

$\therefore x = 1 - \frac{28}{5}$ or $= 1 + 4$

$= -\frac{23}{5}$ $= 5$

$(-\frac{23}{5}; -\frac{14}{5})$ $(5; 2)$ (6)

(d) $kx^2+12x+k=0$.

equal roots $\Rightarrow b^2-4ac=0$ ✓

$144-4k^2=0$.

$4k^2=144$ ✓

$k^2=36$ ✓

$k=\pm 6$ ✓

(4)

Q3 [12]

(a) $(2+\sqrt{7})(4-\sqrt{7})$ ✓

$=8+4\sqrt{7}-2\sqrt{7}-7$

$=1+2\sqrt{7}$.

$a=1$ ✓ $b=2$. ✓

(2)

(b) $\dfrac{\sqrt{50}-\sqrt{8}}{\sqrt{72}}$

$=\dfrac{5\sqrt{2}-2\sqrt{2}}{6\sqrt{2}}$ ✓ ✓ ✓

$=\dfrac{3\sqrt{2}}{6\sqrt{2}}=\dfrac{1}{2}$ ✓

(3)

(c) $\left(\dfrac{2x^2}{16x^{-1}}\right)^{\frac{1}{3}}$

$=\left(\dfrac{x^3}{8}\right)^{\frac{1}{3}}$ ✓

$=\dfrac{x}{2}$ ✓

(3)

(d) $\sqrt{\dfrac{2^{m+5}+2^{m+2}}{2^{m-2}}}$

$=\sqrt{\dfrac{2^m(2^5+2^2)}{2^m\cdot 2^{-2}}}$ ✓

$=\sqrt{36\cdot 4}$ ✓

$=12$ ✓

(4)

Q4 [6]

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

$500\,000=P\left(1+\dfrac{15\%}{2}\right)^{10}$ ✓ ✓ ✓

$P=242\,596,96$ ✓

(3)

(b) $i_{eff}=\left(1+\dfrac{i_{nom}}{m}\right)^m-1$ ✓

$i_{eff}=\left(1+\dfrac{12,5\%}{12}\right)^{12}-1$ ✓

$i=13,24\%$ ✓

(3)

Question 5 [7]

(a) $12+17+8+p=42$

$p=5$ ✓

$20+8+q=40$

$q=12$ ✓

$r=100-(20+25+12+17+8+5+12)$ ✓

$=1$

(3)

(b)(1) P(Swimming only) ✓

$=\dfrac{8}{100}=\dfrac{2}{25}$ or $0,08$ ✓ (1)

(2) P(B but not S) $=\dfrac{45}{100}=\dfrac{9}{50}$ ✓ (1)

(c) P(basketball plus 1 other)

$=\dfrac{(25+12)}{74}$ ✓

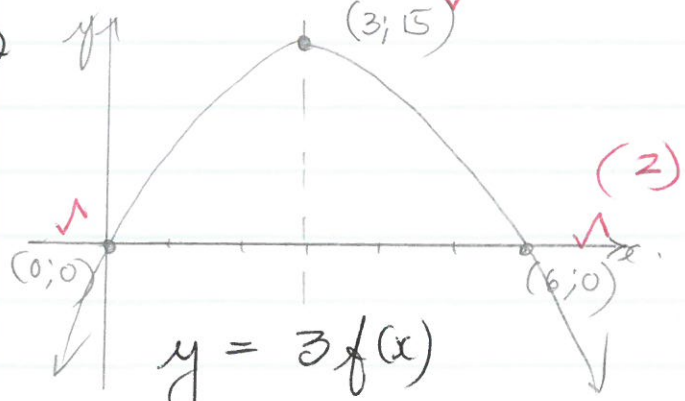
$=\dfrac{37}{74}$

$=\dfrac{1}{2}$

(2)

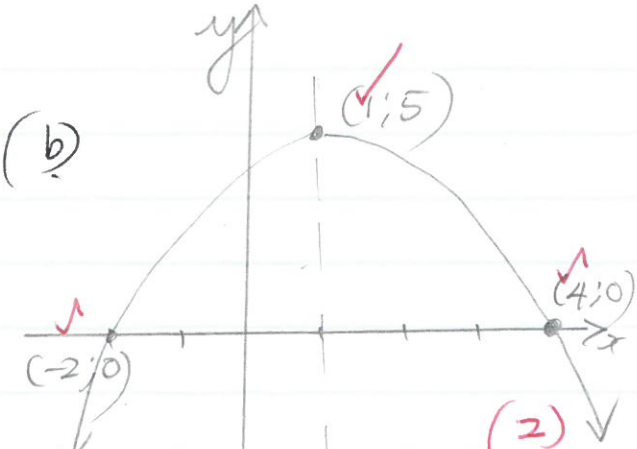
## Question 6 [4]

(a)




$y = 3f(x)$ (2)

(b)




$y = f(x+2)$. (2)

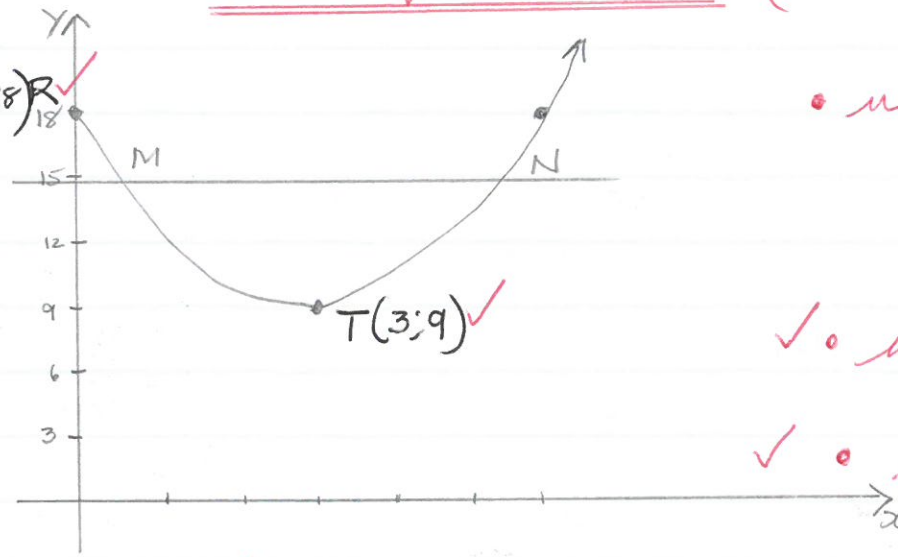
## Question 7 [10]

(a) $f(x) = x^2 - 6x + 18$

$= x^2 - 6x + 9 + 9$

$= (x-3)^2 + 9$ (3)

(b)




- no need to write words of R and T if the scale is clear.
- no negative x values
- shape, scale etc.

(4)

(c) $y = 15$ ✓ drawn on sketch.

$x^2 - 6x + 18 = 15$

$x^2 - 6x + 3 = 0$

$x = \frac{6 \pm \sqrt{36-12}}{2} = \frac{6 \pm \sqrt{24}}{2}$

$= 3 \pm \sqrt{6}$ ✓ (3)

Q8. [10]

(a) 5; 12; 23; 38

$d_1$ 7 11 15 19 23

4 next 2 terms: 57; 80 ✓ ✓

$2a = 4$ $\quad 3a+b = 7$ $\quad 2+1+c = 5$

$a = 2$ ✓ $\quad b = 7-6 = 1$ ✓ $\quad c = 2$ ✓

$T_n = 2n^2 + n + 2$ ✓ (6)

(b) $T_2 = 1$ $\quad$ 1; −6; −14

−6 ✓ −7 −8

−1 −1 ✓

(1) 2nd difference is −1 ✓ (2)

(2) 1st term 7 ✓ (2)

Section B.

Q 9(a) $g(x) = \frac{2}{x+1} + 2$ [19] Domain $x \in \mathbb{R}$ and $x \neq -1$ ✓ ✓ (2)

(b) $h(x) = 2^{x+1} - 3$ Range $y > 3$ or $y \in (3; \infty)$ ✓ ✓ (2)

3 and brackets ✓ etc

(c) $f(x) = \frac{1}{x-1} - 2$ $\quad y = x-1-2$

$y = x - 3$ ✓ ✓ (2)

(d) (2;1) $\quad x = 2$, $y = 1$ asymptotes. $\quad f(x) = \frac{1}{x+p} + q$.

$f(x) = \frac{1}{x-2} + 1$

$p = 2$ ✓ $\quad q = 1$ ✓ (2)

(e) $y + 5^{x+2} = 5$

X int. $y = 0$ $\quad 5^{x+2} = 5^1$ ✓

$x = -1$ ✓

(−1; 0)

Y int $x = 0$ ✓.

$y + 5^2 = 5$

$y = -20$. ✓

(0; −20) (3)

(f) $f(x) = 2^x + q$.

sub $(0; -\frac{1}{2})$. ✓

$-\frac{1}{2} = 1 + q$

$-1\frac{1}{2} = q$ ✓ (2)

$g(x) = mx + c$

$= -\frac{1}{4}x - \frac{1}{2}$ ✓ ✓ (1)

(g) $h(x) = \frac{k}{x}$ $x < 0$.

(1) sub $A(-\frac{1}{2}; -6)$

$-6 = \frac{k}{-\frac{1}{2}}$ ✓ (1)

$3 = k$

(2) (a) $y = \frac{3}{x} + 3$ ✓ (1)

(b) $y = -\frac{3}{x}$ ✓ (1)

(c) $y = \frac{3}{x-1}$ ✓ $- 2$ ✓ (2) [19]

~~Q10.~~ [19]

(a) $x^2 + x - 3 + \frac{1}{x^2 + x - 3} = -2$

let $x^2 + x - 3 = k$ ✓

$k + \frac{1}{k} = -2$ ✓

$k^2 + 2k + 1 = 0$

$(k+1)(k+1) = 0$ ✓

$k = -1$ ✓

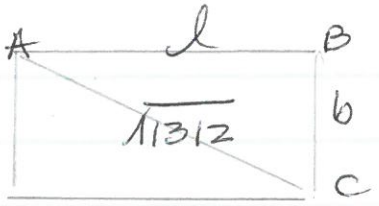
$x^2 + x - 3 = -1$

$x^2 + x - 2 = 0$ ✓

$(x+2)(x-1) = 0$

$x = -2$ or $1$. ✓ (6)

(b)




$2(l+b) = 80$

$l+b = 40$. ✓

$b = 40 - l$.

In $\triangle ABC$

$l^2 + (40-l)^2 = 1312$ ✓ Pythag.

$l^2 + 1600 - 80l + l^2 - 1312 = 0$

$2l^2 - 80l + 288 = 0$ ✓

$l^2 - 40l + 144 = 0$.

$(l-36)(l-4) = 0$ ✓

$l = 36$ or $l = 4$.

Dimensions of room are $36 \times 4$. ✓ (5)

(c) (1) $3(2x+1) > 5 - 2x$

$6x + 3 > 5 - 2x$ ✓

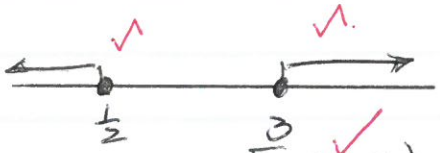
$8x > 2$

$x > \frac{1}{4}$ ✓ (2)

(2) $2x^2 - 7x + 3 \geq 0$ ✓

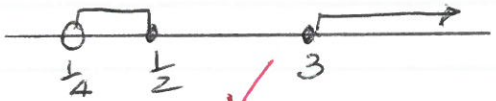
$(2x-1)(x-3) \geq 0$

CV $= \frac{1}{2}$ or $3$ ✓




$x \in (-\infty; \frac{1}{2}]$ or $x \in [3; \infty)$ ✓ (4)

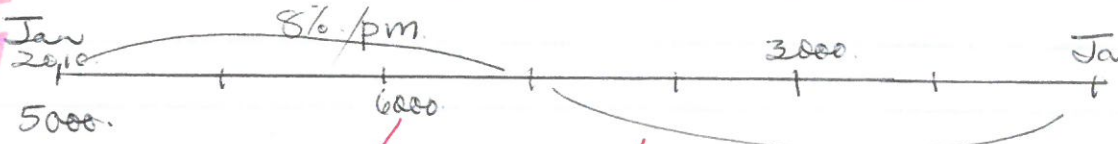
(3)




$x \in (\frac{1}{4}; \frac{1}{2}]$ ✓ or $x \in [3; \infty)$ ✓ (2)

Q11 (a)

[13]




$A_1 = 5000\left(1+\frac{8\%}{12}\right)^{36}\left(1+\frac{9\%}{4}\right)^{16}$ 9% quarterly (7 years) $= 9067,09$

$A_2 = 6000\left(1+\frac{8\%}{12}\right)^{12}\left(1+\frac{9\%}{4}\right)^{16} = 9276,68$

$A_3 = 3000\left(1+\frac{9\%}{4}\right)^{8} = 3584,49$

Amount $= A_1 + A_2 - A_3 = \underline{21928,26}$ (6)

11(b) (1) cost = R325 000 (1)

(2) depreciating on a reducing balance method (1)

(3) $A = P(1-i)^n$ Sub (2; 208 000)

$208000 = 325000(1-i)^2$

$\sqrt{\frac{208}{325}} - 1 = -i$

$\underline{i = 20\%}$ (3)

(4) $A = 325\,000(1-20\%)^6$ (2)

$= \underline{R.85\,196,80}$

[13]

Q12. [10]

(a) (1) $p = \frac{1}{3}$ ✓ $q = \frac{3}{8}$ ✓

$r = \frac{6}{8} = \frac{3}{4}$ ✓ $s = \frac{1}{4}$ ✓ (3)

(2) P(Bag A and white)

$= \frac{2}{3} \times \frac{5}{8}$ ✓ $= \frac{5}{12}$ ✓ (2)

(3) $P(W) = \frac{5}{12} + pr$

$= \frac{5}{12} + \frac{1}{3} \cdot \frac{3}{4}$

$= \frac{2}{3}$ ✓ (2)

(b) (1) $\frac{3}{10}$ Y $\frac{2}{9}$ Y $\frac{1}{8}$ Y

9

$P(3 \text{ yellows}) = \frac{3}{10} \cdot \frac{2}{9} \cdot \frac{1}{8} = \frac{1}{120}$ ✓ (2)

(2) P(at least 1 green)

$= P(\text{all yellow})'$

$= 1 - \frac{1}{120}$

$= \frac{119}{120}$ ✓ (1)

Q13. (a) $h(x) = -x^2 + 3x + 10$.

Axis of S $x = \frac{-b}{2a} = \frac{-3}{-2} = \frac{3}{2}$ ✓

$x = \frac{3}{2}$ ✓ (2) Already just write $\frac{3}{2}$.

(b) X-int. $x^2 - 3x - 10 = 0$

$(x-5)(x+2)$ ✓

$x = 5$ or $-2$.

$h(x) < 0$ for $x \in (-\infty; -2)$ or $x \in (5; \infty)$ ✓ ✓ (3)

(c) $h(x) \geq h(x)$ ✓ ✓

for $x \in [0; 5]$ (1) [6]