MARKING GUIDELINE

PRELIM PAPER 1

2016

QUESTION 1:

a. 1. $\frac{2}{n} = x$

$n \neq 0$ ✓ (2)

2. $-3(x+1)(x-3) < 0$

$x = -1 \quad x = 3$ (3)

$x < -1$ or $x > 3$ ✓

3. $x + 5 = \sqrt{3 - 3x}$

$x^2 + 10x + 25 = 3 - 3x$

$x^2 + 13x + 22 = 0$ (5)

$x = -2 \quad x \neq -11$

b: $\frac{4 \cdot 3^a \cdot 3^2 - 3 \cdot 3^a}{5 \cdot 3^a \cdot 3^1 - 3 \cdot 3^a}$

$= \frac{3^a(4 \cdot 3^2 - 3)}{3^a(5 \cdot 3^1 - 3)}$ ✓ (4)

$= 11/4$ ✓

4. $3^{x^2-1} = 3^{-3x-1}$

$x^2 - 1 = -3x - 1$ ✓ (4)

$x^2 + 3x = 0$

$x = -3$ or $x = 0$

QUESTION 2

4 ; x ; 34

$x - 4 \quad 34 - x$

$(34 - x) - (x - 4) = 10$ ✓

$x = 14$ ✓ (4)

a) 4th term = 64 ✓

b) $2a = 10$

$a = 5$ ✓

$3a + b = 10$

$b = -5$ ✓

$a + b + c = 4$ (4)

$c = 4$ ✓

$T_n = 5n^2 - 5n + 4$ ✓

c) Minimum value = 4 ✓ (2)

QUESTION 3

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

$f(x+h) = \frac{-1}{2(x+h)}$ ✓

$f'(x) = \lim_{h\to 0} \frac{\frac{-1}{2(x+h)} + \frac{1}{2x}}{h}$ ✓

$= \lim_{h\to 0} \frac{-2x + 2x + 2h}{(2x)(2x+2h)h}$ ✓✓

$= \frac{1}{2x^2}$ ✓ (5)

b) $y = x^{1/2} - 0$

$\frac{dy}{dx} = \frac{1}{2}x^{-1/2} = \frac{1}{2x^{1/2}}$ ✓✓ (2)

c) $y = x^{1/3} + \frac{2}{5}x^{-1}$

$\frac{dy}{dx} = \frac{1}{3}x^{-2/3} - \frac{2}{5}x^{-2}$ ✓✓

$= \frac{1}{3x^{2/3}} - \frac{2}{5x^2}$ ✓✓ (4)

QUESTION 4

a) $f(x) = 3x - 7$

$g(x) = \frac{12}{x-2}$

1. $x = 3y - 7$

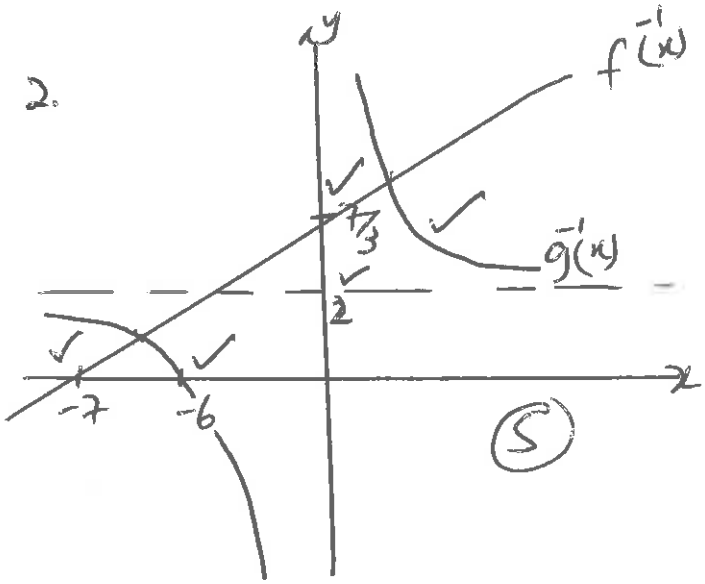
$\frac{x+7}{3} = f^{-1}(x)$ ✓✓

$x = \frac{12}{y-2}$ (5)

$y = \frac{12}{x} + 2$

$g^{-1}(x) = \frac{12}{x} + 2$ ✓✓ ✓ $x \neq 0$

2.



✓✓✓✓✓ (5)

3) $g^{-1}(x) > f^{-1}(x)$ (3)

$12/x + 2 = \frac{x+7}{3}$

$x = 5,5$ or $x = -6,5$

$x < -6,5$ ✓ or $0 < x < 5,5$ ✓✓

b) $2x - 1 > 0$

$x > 1/2$ ✓✓ (2)

QUESTION 5

$f(x) = 2(x-2)^2 - 2$

a) Turning point $(2; -2)$ ✓ (2)

b) y int: $x = 0$

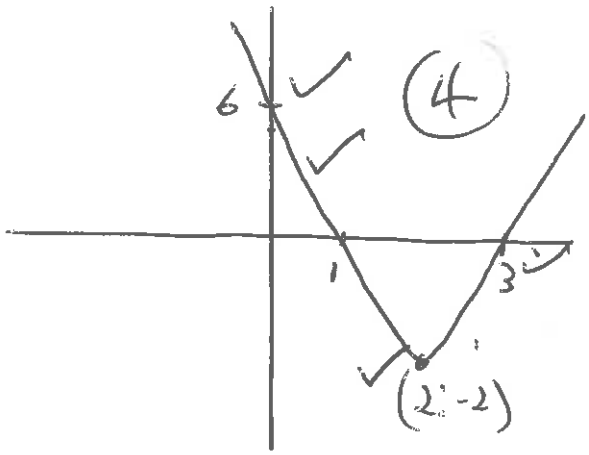
$y = 6$ ✓

$2(x-2)^2 - 2 = 0$ ✓ (4)

$x - 2 = \pm 1$ ✓

$x = 3$ ✓ or $x = +1$

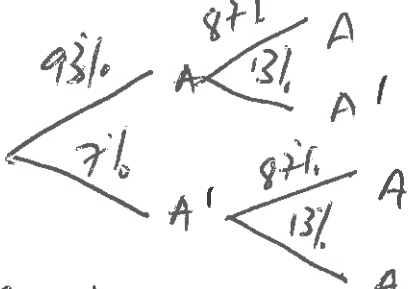
c)



(4)

d) $k > 6$ ✓✓ (2)

QUESTION 6



a) $P(A' \cap A') = 7\% \times 13\%$ ✓ (3)

$= 0,0091$

b) $P(A \cap A) = 93\% \times 87\%$ ✓ (3)

$= 0,8091$

c) $P(\text{At least one}) = 1 - 13\% \times 7\%$ ✓

$= 0,9909$ ✓ (3)

SECTION B

QUESTION 7:

a) $7C_2 = 21$ ✓ (3)

b) $4C_2 = 6$ ✓ (3)

c) $3C_1 \times 4C_1 = 12$ ✓ (3)

QUESTION 8

a) $749,77 = 500\left(1 + \frac{6,811}{4}\right)^{4n}$ ✓

$4n = 23,999\ldots$ (4)

$n = 5,99\ldots$ ✓

$n = 6$ years

b) $F = 350\left(\frac{\left(1 + \frac{0,0553}{12}\right)^{8\times12} - 1}{\frac{0,0553}{12}}\right)$ ✓

$= 42141,06$ ✓

$A = 42141{,}06\left(1+\frac{0{,}0553}{12}\right)^{21\times 12}$ ✓

$= R134\,243{,}45$ ✓ (6)

2. Total Deposit $= 350 \times 12 \times 8$

$= R33\,600$ ✓

At the end of period

$= 134\,243{,}45 - 33600$

$= 100\,643{,}45$ ✓

∴ Difference $= 100643{,}45 - 33600$

$= 67043{,}45$ ✓ (3)

c) $A = 8500(1+11.)^1(1+21.)^2 \cdot (1+31.)^3(1+41.)^4$ ✓

$= R114\,17{,}89$ ✓ (6)

QUESTION 9

a) $199+195+\ldots+7+3 =$

$197+\ldots+1+x$ ✓ ✓

$\sum_{n=1}^{50}(203-4n) = \sum_{n=1}^{50}(201-4n)+x$

$5050 = 4950 + x$ ✓ (4)

$x = 100$ ✓

b) $ar = 4 \quad a = \frac{4}{r}$ ✓

$\frac{a}{1-r} = 25$ ✓

$a = 25(1-r)$ (4)

$\frac{4}{r} = 25 - 25r$ ✓

$4 = 25r - 25r^2$ ✓

$25r^2 - 25r + 4 = 0$

c) $T_r = 2r - 5$

$\sum_{r=1}^{n}(2r-5) = \frac{n}{2}(2(-3)+(n-1)2)$ ✓ ✓

$= \frac{n}{2}(-6+2n-2)$ ✓ (4)

$= \frac{n}{2}(-8+2n)$

$= -4n+n^2$ ✓

$= n(n-4) = R\text{H}2.$

QUESTION 10:

a) $f(x) = a(x+3)(x+1)(x-2)$ ✓

$16 = a(1+3)(1+1)(1-2)$

$16 = -8a$ ✓

$a = -2$ ✓ (4)

$\therefore f(x) = -2(x^3+2x^2-5x-6)$ ✓

$= -2x^3 - 4x^2 + 10x + 12$

b) $f'(x) = -6x^2 - 8x + 10 = 0$ ✓✓

$x = 0,79 \quad x = -2,12$

$y = 16,4 \quad y = -8,12$ ✓

(0,79; 16,4) (-2,12; -8,12) (4)

c) $f''(x) = -12x - 8 = 0$ ✓

$x = -2/3$ ✓ (3)

$x < -2/3$ ✓

d) $16x + y - k = 0$

$y = -20x + k$ ✓

$-6x^2 - 8x + 10 = -20$ ✓ (6)

$-6x^2 - 8x + 30 = 0$

$x = -3$ ✓ $\quad x = 5/3$ ✓

$y = 0 \quad y = \frac{224}{27}$

$k = -60$ ✓ $\quad k = \frac{1124}{27}$ ✓

(41,6)

e) $x < -2/3$ ✓ or $x > 0$ ✓ (2)

QUESTION 11:

a) $(2\sqrt{3})^2 = r^2 + x^2$ ✓✓ (2)

$r^2 = 12 - x^2$

b) $V = \pi r^2 . x$ ✓

$= \pi(12 - x^2)x$ ✓✓ (3)

c) $V = 12\pi x - \pi x^3$

$V'(x) = 12\pi - 3\pi x^2 = 0$ ✓✓

$x = 2$ ✓ (4)

d) $r^2 = 12 - 4$ ✓

$r = 2\sqrt{2}$ ✓ (3)

QUESTION 12

$-2 < x < 0$ ✓ $\quad x > 4$ ✓

$-2 < a^2 < 0$ $\quad a^2 > 4$ (4)

$a > 2$ ✓

or $a < -2$ ✓