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MATHS

QUESTION 1

a. $\left(\frac{3^{-3} \cdot x^{-3}}{27 \cdot x^{-3}}\right)^{-2/3}$

$= (3^{-6})^{-2/3}$
 $= 3^4$ (3)

b. 1. $2x^2 - x = 0$
 $x = 0$ or $x = \frac{1}{2}$ (2)

2. $3x^2 + 5x - 2 \geq 0$ (4)
 CV: $x = \frac{1}{3}$, $x = -2$
 $x \leq -2$ or $x \geq \frac{1}{3}$

3. $20 - 2x = (6 - x)^2$
 $20 - 2x = 36 - 12x + x^2$
 $x^2 - 10x + 16 = 0$
 $x \neq 8$ or $x = 2$ (5)

4. $7^x - 8 + \frac{7}{7^x} = 0$
 $7^{2x} - 8 \cdot 7^x + 7 = 0$
 $(7^x - 7)(7^x - 1) = 0$
 $7^x = 7$ or $7^x = 1$
 $x = 1$ or $x = 0$ (6)

QUESTION 2:

91. $26^2 - 25^2 + 24^2 - 23^2 = 98$ (2)

2. $T_n = (n+3)^2 - (n+2)^2 + (n+1)^2 - n^2$

$T_n = 4n + 6$ (6)

6. P: 18, 28, 4p
 $18 - p$, 10 , $4p - 28$

$10 - 18 + p$, $4p - 38$ (6)

$-8 + p = 4p - 38$

$30 = 3p$
 $p = 10$

QUESTION 3:

a) $\lim_{x \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

$= \frac{f(h) - f(0)}{h}$ (2)

- 1. F
- 2. T
- 3. F
- 4. F

QUESTION 4:

c) $f(x+h) = -(x+h)^2 + B(x+h)$
 $= -x^2 - 2xh - h^2 + Bx + Bh$ ✓

$f'(x) = \lim_{h \rightarrow 0} \frac{-x^2 - 2xh - h^2 + Bx + Bh + x^2 - Bx}{h}$ ✓

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

$= -2x + B$ ✓

(5)

d. $y = x^{2/n} - \frac{3}{2}x^{-1}$

$\frac{dy}{dx} = \frac{2}{n}x^{2/n-1} + \frac{3}{2}x^{-2}$ ✓ (4)

$= \frac{2}{n}x^{2/n-1} + \frac{3}{2x^2}$ ✓

e. $f'(x) = 3x^2 + 2ax + 9$ ✓

$f''(x) = 6x + 2a > 0$ ✓ (4)

$18 + 2a > 0$

$2a > -18$

$a > -9$ ✓

a. $q = 2$ ✓

$p = -1$ ✓

$-4 = \frac{a}{3/2 - 1} - 2$ ✓

$a = -1$ ✓

(4)

b. $D: x \in \mathbb{R} : x \neq 1$ ✓

$R: y \in \mathbb{R} : y \neq -2$ ✓ (2)

c. $m(x) = \frac{1}{x+1} - 2$ ✓ (3)

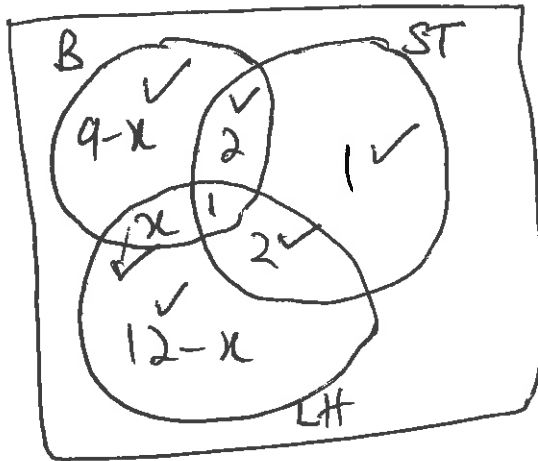
QUESTION 5:

a) $0,8 = 0,6 + 0,3 - P(A \cap B)$

$P(A \cap B) = 0,1 \neq 0$

∴ not mutually exclusive

b)



$9-x + 2 + 1 + x + 2 + 1 + 12-x = 24$

$27-x = 24$

$x = 3$

QUESTION 6:

a) $\frac{20!}{8!6!4!2!} = 1745944200$

b) $R \dots R$
 $\frac{18!}{6!6!4!2!} = \frac{14}{95} (0,15)$

QUESTION 7:

a. i.

$B0 = 350000 \left(1 + \frac{9\%}{2}\right)^6 - 21000 \left(\frac{\left(1 + \frac{9\%}{2}\right)^6 - 1}{\frac{9\%}{2}} \right)$

$= R314\,736,32$

2. Interest = $21000 \times 6 - (350000 - B0)$
 $= R90\,736,82$

b. $3200000 \left(1 + \frac{9,5\%}{12}\right)^2 = 350000 \left[\frac{1 - \left(1 + \frac{9,5\%}{12}\right)^{-n}}{\frac{9,5\%}{12}} \right]$

$n = 168,86$
 $14,05 \text{ years}$

QUESTION 8:

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1. $k + (n-1)k = 200$

$n = \frac{200}{k}$ ✓ (2)

2. $S_{\frac{200}{k}} = \frac{200}{2k} (k + 200)$ (3)
 $= \frac{100}{k} (k + 200)$ ✓

b. $a = 5$ $r = \frac{4}{5}$

1. $T_{20} = 5 \left(\frac{4}{5} \right)^{20-1}$ ✓ ✓ (2)
 $= 0,07$

2. $S_{\infty} = \frac{5}{1 - \frac{4}{5}} = 25$ ✓ (2)

3. $S_k = \frac{5 \left(\left(\frac{4}{5} \right)^k - 1 \right)}{\left(\frac{4}{5} \right) - 1}$ ✓
 $> 24,95$
 $-25 \left(\left(\frac{4}{5} \right)^k - 1 \right) > 24,95$

$\left(\frac{4}{5} \right)^k < -0,998 + 1$ (4)

$\left(\frac{4}{5} \right)^k < 0,002$

$k \log \left(\frac{4}{5} \right) < \log(0,002)$

$k > \frac{\log(0,002)}{\log(0,8)}$ ✓

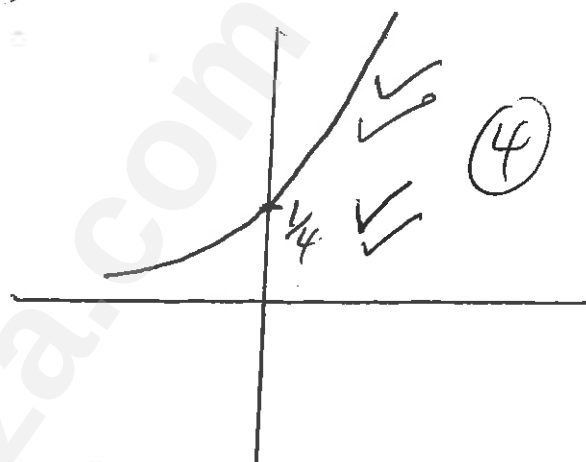
4. $k = 28$

QUESTION 9:

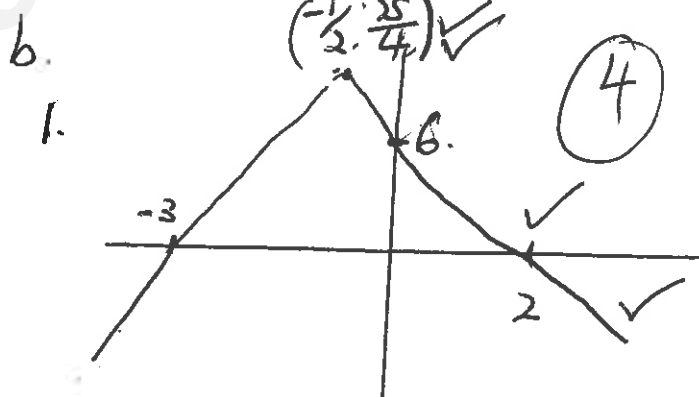
a1. $b = 2$ ✓ (2)

2. $f^{-1}(x) = 2^x$

$f^{-1}(x-2) = 2^{x-2}$



3. $x > 0$ ✓ (2)



2. Turning points

$(-1, \frac{25}{4})$ ✓ (2)

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QUESTION 10:

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a) $d=0$ ✓
 $y = -(x)(x-6)^2$
 $= -x^3 + 12x^2 - 36x$ (4)

$b = 12$ ✓ $c = 36$ ✓

b. $f'(x) = -3x^2 + 24x - 36 = 0$ ✓
 $x = 2$ $x = 6$ (3)
 $A(2; -32)$ ✓

c. $T(3; -27)$

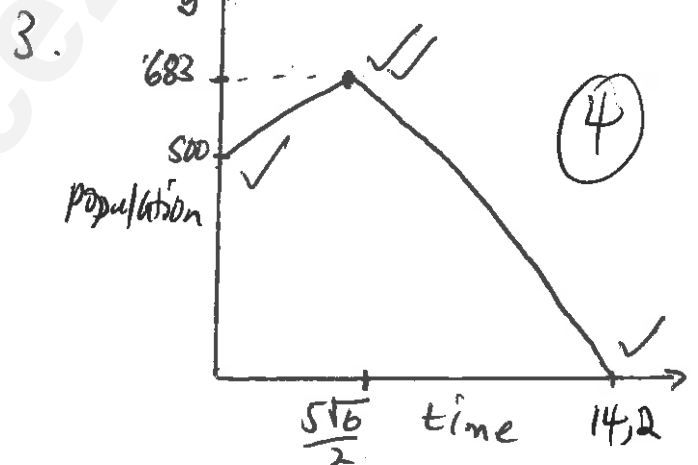
$f'(3) = 9$ ✓
 $-27 = 9(3) + c$ (5)
 $y = 9x - 54$ ✓

QUESTION 11:

a) 1. $P'(t) = 45 - 1,2t^2 = 0$ ✓
 $t^2 = 37,5$ (4)
 $t = \frac{5\sqrt{6}}{2} (6,12)$ ✓

$P\left(\frac{5\sqrt{6}}{2}\right) = 683,71$ ✓
 $\therefore \text{max population} = 683$ ✓

2. $45t - 0,4t^3 + 500 = 0$ ✓
 $t = 14,2$ ✓ (3)



b) $V = knr^2 - kr^3$
 $v'(r) = 2knr - 3kr^2 = 0$ ✓
 $r \neq 0$ ✓ $2n = 3r$ (5)
 $r = \frac{2n}{3}$ ✓

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