GRADE : 11 DATE : ____ / ____ / 20 20

SUBJECT : Mathematics

TITLE : Nov P I

SOLUTIONS

EXAMINER : Mr A. Slaughter

TOTAL MARKS : 150 TIME : 3 hour(s)

1.1.1.	$7x^2 - x = 0$	
	$x(7x-1) = 0$ ✓	
	$x = 0$ or $\frac{1}{7}$ ✓both	2
1.1.2.	$12x^2 - 8x - 13 = 0$	
	$(\quad)(\quad) = 0$	
✓	$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(12)(-13)}}{2(12)}$	
	$= \frac{8 \pm \sqrt{688}}{24}$	
	$= 1{,}43$ ✓ or $-0{,}76$ ✓	3
1.1.3.	$16 - \sqrt{x-4} = x$	
	$-\sqrt{x-4} = x - 16$	
	$(-\sqrt{x-4})^2 = (x-16)^2$	
	$+(x-4) = x^2 - 32x + 256$ ✓	
	$x - 4 = x^2 - 32x + 256$	
	$0 = x^2 - 33x + 260$ ✓	

	$(x-20)(x-13) = 0$ ✓	
	$\therefore x = \cancel{20}$ reject or 13	4
	✓ons with selection	
1.1.4.	$x(17-6x) \leq -14$	
	$17x - 6x^2 \leq -14$	
	$-6x^2 + 17x + 14 \leq 0$	
	$\div -1$:	
	✓ $6x^2 - 17x - 14 \geq 0$	
	✓ $(2x-7)(3x+2) \geq 0$	
	poi : $(2x-7)(3x+2) = 0$	
	$x = \frac{7}{2}$ or $-\frac{2}{3}$	
	$(2x-7)(3x+2)$: $+$ 0 $-$ 0 $+$; x: $-2/3$, $7/2$	
	✓✓ or 0 $x \leq -2/3$ or $\frac{7}{2} \leq x$	4
	• $(2x-7)(3x+2) \leq 0$	
	b/d max 1/4	
	✓ CA factors	

• and ; $<$ $\frac{1}{2}$

• $\frac{7}{2} \leq x \leq -\frac{2}{3}$ $\frac{0}{2}$

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

POI : $x(x+2)(3-x) = 0$

$x = 0 ; -2$ or 3

$x(x+2)(3-x)$	+	0	−	0	+	0	−	
x		-2		0		3		

$-2 < x < 0$ or $3 < x$

✓✓ or 0 — 2

1.1.6. $5x^{3/5} + 18 = 0$

$x^{3/5} = -\frac{18}{5}$ ✓

$\left(x^{3/5}\right)^{5/3} = \left(-\frac{18}{5}\right)^{5/3}$ ✓

$x = -8,46$ ✓ — 3

• $x = \sqrt[\frac{5}{3}]{-18/5}$

max $1/3$ ✓

1.1.7. $3^{x+1} - 2 = 5 . 3^{-x}$

$3^x . 3^1 - 2 = \frac{5}{3^x}$

let $k = 3^x$

$k.3 - 2 = \frac{5}{k}$

LCD $= k$ $(\therefore k \neq 0)$

× thru

$3k^2 - 2k = 5$

$3k^2 - 2k - 5 = 0$ ✓

$(3k-5)(k+1) = 0$ ✓

$k = 5/3$ or -1

$3^x = 5/3$ ✓ $3^x = -1$

$x = \frac{\log 5/3}{\log 3}$ must show ✓ no soln ✓

$= 0,46$ ✓ — 6

1.2.	$x^2 - 5xy - y^2 = 100$	
	$3y - x - 22 = 0$	
	$3y - 22 = x$ ✓	
✓	$(3y-22)^2 - 5(3y-22)y - y^2 = 100$	
	$9y^2 - 132y + 484 - 5(3y^2 - 22y) - y^2 = 100$	
	$9y^2 - 132y + 484 - 15y^2 + 110y - y^2 = 100$	
	$-7y^2 - 22y + 384 = 0$	
✓	$\div -1$: $7y^2 + 22y - 384 = 0$	
✓	$(y-6)(7y+64) = 0$	
both ✓	$y = 6$ or $-\frac{64}{7}$	
	$\therefore x = 3(6) - 22$ or $3(-\frac{64}{7}) - 22$	
both ✓	$= -4$ $\quad = -\frac{346}{7}$	6
	• $(x-6)(7x+64) = 0$	
	$x = 6$ or $-\frac{64}{7}$	
	✓ CA bld max 4/6	

1.3.1.	$(x-2)(x+1) = x(3-k) + k$	
	$x^2 - x - 2 = 3x - xk + k$	
	$x^2 - 4x + xk - 2 - k = 0$ ✓	
	$x^2 + x(-4+k) - 2 - k = 0$	
	$\Delta = (-4+k)^2 - 4(1)(-2-k)$ ✓	
	$= 16 - 8k + k^2 + 8 + 4k$	
	$= k^2 - 4k + 24$	2
1.3.2.	$\Delta = k^2 - 4k + 24$	
	$= k^2 - 4k + (-2)^2 - (-2)^2 + 24$	
	$= (k-2)^2 - 4 + 24$	
	$= (k-2)^2 + 20$	2
	✓ ✓	
1.3.3.	When $k \in \mathbb{R}$:	
	$(k-2)^2 \geq 0$	
	$(k-2)^2 + 20 \geq 20$	
✓ argument – not just $\Delta > 0$	$(k-2)^2 + 20 > 0$	
	$\Delta > 0$	
✓ A	Roots are real and	
	unequal	2

2.1.1.	$\sqrt{48} - 5\sqrt{27}$	
	$= \sqrt{16.3} - 5\sqrt{9.3}$ ✓ must show	
	$= \sqrt{16}\sqrt{3} - 5\sqrt{9}\sqrt{3}$	
	$= 4\sqrt{3} - 5.3.\sqrt{3}$	
	$= 4\sqrt{3} - 15\sqrt{3}$ ✓	
	$= -11\sqrt{3}$ ✓	3
2.1.2.	$x^{2/5}(3x^{-2/5} - 4x^{5/2})$	
	$= 3.x^{0} - 4x^{29/10}$	
	$= 3 - 4x^{29/10}$	2
	✓ ✓	
2.2.	$2^{2x} - 3.4^{x-1}$	
	$= 2^{2x} - 3.(2^{2})^{x-1}$	
	$= 2^{2x} - 3.2^{2x-2}$ ✓	
	$= 2^{2x} - 3.2^{2x}.2^{-2}$	
	$= 2^{2x}(1 - 3.2^{-2})$	
	$= 2^{2x}(1 - \frac{3}{2^{2}})$	
	$= 2^{2x}(1 - \frac{3}{4})$	
	$= 2^{2x}.\frac{1}{4}$	3
	✓ ✓	
	$(= 2^{2x-2}$ ☺$)$	

2.3.	$\frac{\sqrt{\sqrt{21}-\sqrt{5}}\ \sqrt{\sqrt{21}+\sqrt{5}}}{\sqrt{7}}$	
	$= \frac{\sqrt{(\sqrt{21}-\sqrt{5})(\sqrt{21}+\sqrt{5})}}{\sqrt{7}}$	
	$= \frac{\sqrt{21-5}}{\sqrt{7}}$ ✓	
	$= \frac{\sqrt{16}}{\sqrt{7}}$	
	✓ ✓	
	$= \frac{4}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$	
	$= \frac{4}{7}\sqrt{7}$	
	✓ ✓	
	$a = \frac{4}{7}$ $b = 7$	5

3.1.	$4;\ -3;\ -16;\ -35;\ \ldots$	
	$-7 \quad -13 \quad -19$	
	$-6 \quad -6$	
3.1.1.	-60 ✓	1
3.1.2.	$d_2 = 2a \quad d_1 = 3a + b \quad T_1 = a + b + c$	
	$-6 = 2a \quad -7 = 3(-3) + b \quad 4 = -3 + 2 + c$	
	$-3 = a$ ✓ $\quad 2 = b$ ✓ $\quad 5 = c$ ✓	
	$T_n = -3n^2 + 2n + 5$ ✓	4
3.1.3.	$T_n = -3n^2 + 2n + 5$	
✓	$-18\,091 = -3n^2 + 2n + 5$	
✓	$3n^2 - 2n - 18\,096 = 0$	
✓	$(n - 78)(3n + 232) = 0$	
	$n = 78$ or $-\frac{232}{3}$ reject	
	✓ ans with selection	4

3.2.	$8x - \pi;\ 6x - \pi;\ 4x - \pi$	
3.2.1.	$d = 6x - \pi - (8x - \pi)$	
	$= 6x - \pi - 8x + \pi$	
	$= -2x$ ✓	1
3.2.2.	$T_n = 8x - \pi + (n-1)(-2x)$ ✓	
	$= 8x - \pi + (-2xn + 2x)$	
	$= 8x - \pi - 2xn + 2x$	
	$= 10x - \pi - 2xn$ ✓	2

3.3.	$T_n = n^2 - 10n + 4$	
	$T_{n+1} = (n+1)^2 - 10(n+1) + 4$	
	$= n^2 + 2n + 1 - 10n - 10 + 4$	
	$= n^2 - 8n - 5$	
	$T_n + T_{n+1} = 9619$	
	$n^2 - 10n + 4 + n^2 - 8n - 5 = 9619$	
	$2n^2 - 18n - 9620 = 0$	
	$\div 2$: $n^2 - 9n - 4810 = 0$	
	$(n - 74)(n + 65) = 0$	
	$n = 74$ or $-\cancel{65}$	
	$\therefore T_{74}$; T_{75}	5
	OR	
	$T_n = n^2 - 10n + 4$	
	$T_{n-1} = n^2 - 12n + 15$	
	$n^2 - 10n + 4 + n^2 - 12n + 15 = 9619$	
	$2n^2 - 22n - 9600 = 0$	
	$n^2 - 11n - 4800 = 0$	
	$(n - 75)(n + 64) = 0$	
	$n = 75$ or $-\cancel{64}$	
	$\therefore T_{74}$; T_{75}	

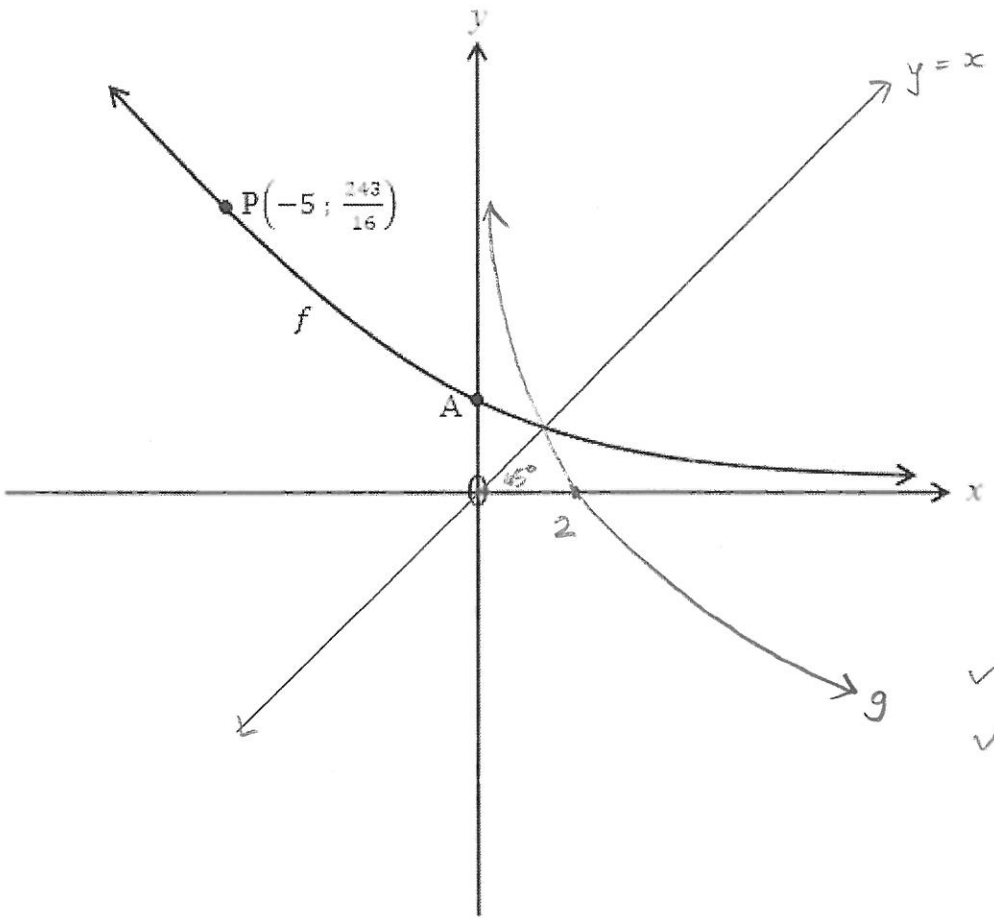
3.4.	$T_n = n^2 - 46n + 520$	
3.4.1	$n = \frac{-(-46)}{2(1)}$	
	$= 23$	2
3.4.2.	$n^2 - 46n + 520 < 0$	
	$(n - 26)(n - 20) < 0$	
	poi $(n-26)(n-20) = 0$	
	$n = 26$ or 20	
	$(n-26)(n-20)$: $+$ 0 $-$ 0 $+$ (at 20, 26)	
	$20 < n < 26$	
	T_{21}; T_{22}; T_{23}; T_{24}; T_{25}	
	$T_{21} = (21)^2 - 46(21) + 520$	
	$= -5$	
	Similarly	
	$T_{22} = -8$	
	$T_{23} = -9$	
	$T_{24} = -8$	
	$T_{25} = -5$	
	$\therefore (-5)(-8)(-9)(-8)(-5)$	
	$= -14\ 400$	3

Name and Surname : .....

Grade/Class : 11/..... **Mathematics Teacher** : .....

ANSWER SHEET FOR QUESTION 4

4.

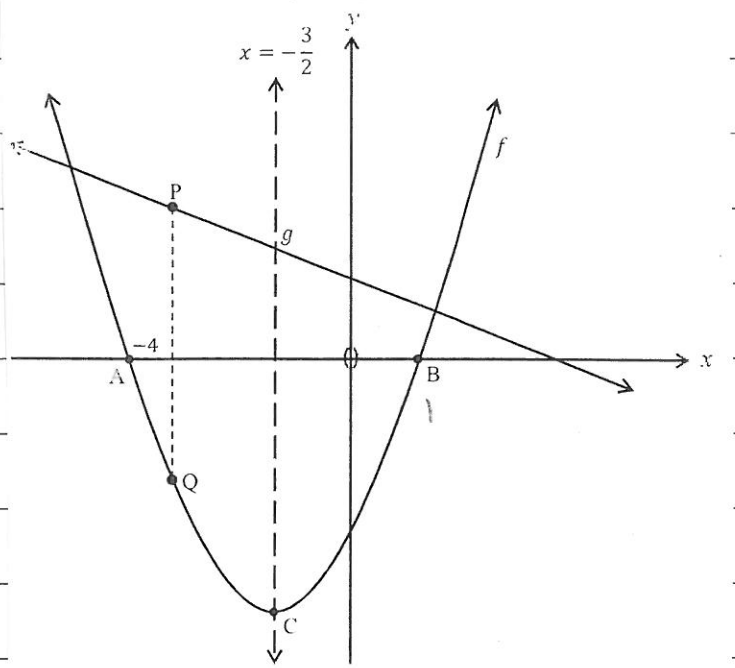


✓ x int
✓ shape + va 2

4.1.	y int : $y = 2.b^0$	
	$= 2$	
	$\therefore A(0;2)$ ✓	1
4.2.	$y = 0$ ✓	1

4.3.	See graph.	
4.4.	$y = 2.b^{x}$	
	Sub $P(-5; \frac{243}{16})$	
	$\frac{243}{16} = 2.b^{-5}$ ✓	
	$\frac{243}{32} = b^{-5}$	
	$\left(\frac{243}{32}\right)^{-\frac{1}{5}} = \left(b^{-5}\right)^{-\frac{1}{5}}$ ✓	
	$\frac{2}{3} = b$ ✓	3
4.5.	f : $y = 2b^{x}$	
	h : f $5\downarrow$ $4\rightarrow$	
	$y = 2.b^{x-4}$ ✓ $- 5$ ✓	2

5.



$f: y = ax^2 + 6x + c$

$g: y = -2x + 4$

5.1. $\frac{x_B + (-4)}{2} = -\frac{3}{2}$ ✓

symmetry

$x_B - 4 = -3$

$x_B = 1$ 1

5.2. $x = -\frac{b}{2a}$

$-\frac{3}{2} = -\frac{6}{2a}$ ✓

$-6a = -12$ ✓

$a = 2$

$\therefore y = 2x^2 + 6x + c$

sub $A(-4;0)$

$0 = 2(-4)^2 + 6(-4) + c$ ✓

$0 = 32 - 24 + c$

$-8 = c$ 3

OR must have a

$y = a(x+4)(x-1)$ ✓

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

$= ax^2 + 3ax - 4a$

$y = ax^2 + 6x + c$

$3a = 6$ ✓ $c = -4a$ ✓

$a = 2$ $= -4(2)$

$= -8$

$f: \; y = 2x^2 + 6x - 8$

$g: \; y = -2x + 4$

5.3. f decr $\downarrow$ L $\rightarrow$ R

$x \in (-\infty; -\frac{3}{2})$ ✓ 1

5.4. $y_c = 2(-\frac{3}{2})^2 + 6(-\frac{3}{2}) - 8$

$= -\frac{25}{2}$ ✓

$\therefore y \in [-\frac{25}{2}; \infty)$ ✓ 2

5.5. $PQ = y_P - y_Q$

$= -2x + 4 - (2x^2 + 6x - 8)$ ✓

$= -2x + 4 - 2x^2 - 6x + 8$

$= -2x^2 - 8x + 12$ ✓

$x_{tp} = \frac{-(-8)}{2(-2)}$

$= -2$ ✓

$PQ_{max} = -2(-2)^2 - 8(-2) + 12$

$= 20$ units ✓ 4

5.6. $f: \; y = 2x^2 + 6x - 8$

$h: \; -y = 2x^2 + 6x - 8$

$y = -2x^2 - 6x + 8$ ✓ 1

5.7. $x = -2 \quad y = 2(-2)^2 + 6(-2) - 8$

$= -12$

$x = 3 \quad y = 2(3)^2 + 6(3) - 8$

$= 28$

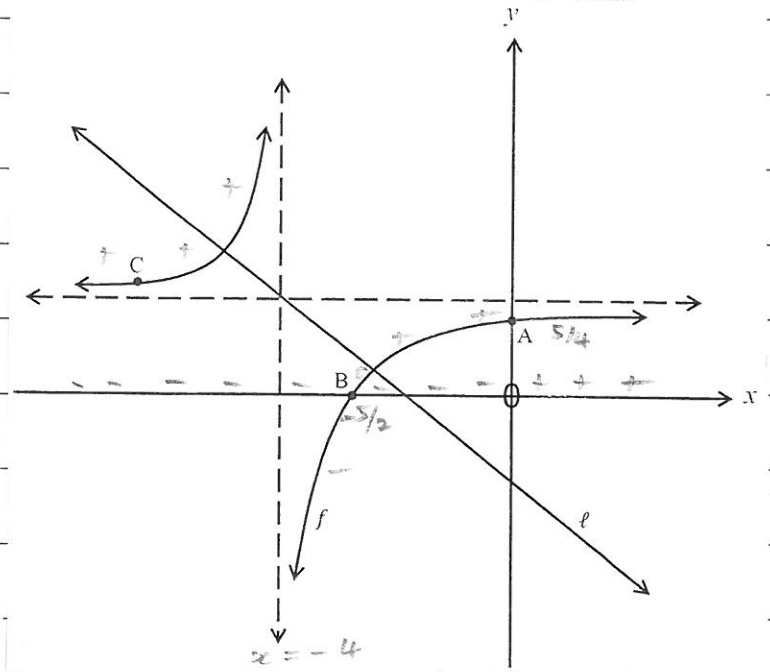
$(-2; -12)$ ✓ both $(3; 28)$

av grad $= \frac{\Delta y}{\Delta x}$

$= \frac{28 - (-12)}{3 - (-2)}$ ✓

$= 8$ ✓ 3

6.



$f: \quad y = \frac{2x+5}{x+4}$

$y = -\frac{3}{x+4} + 2$

6.1.

$$\begin{array}{r} 2 \\ x+4 \overline{)\, 2x+5} \\ \ominus\ 2x \ \ominus\ +8 \\ \hline -3 \end{array}$$

$\therefore \frac{2x+5}{x+4} = 2 + \frac{-3}{x+4}$ 2

6.2.1. y int: $y = -\frac{3}{0+4} + 2$

$= \frac{5}{4}$

$A(0; \frac{5}{4})$ 1

6.2.2. x int: $0 = -\frac{3}{x+4} + 2$

$\frac{3}{x+4} = 2$

LCD $= x+4$ $(\therefore x \neq -4)$

x Hkrn

$3 = 2(x+4)$

$3 = 2x+8$

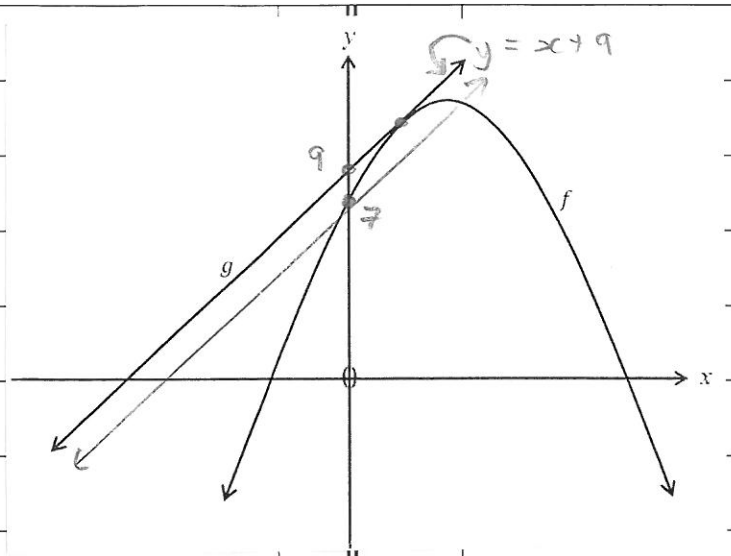
$-5 = 2x$

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

$B(-\frac{5}{2}; 0)$ 1

6.3.	$y = -x$	
	$\therefore\ y = -(x+4) + 2$	
	$= -x - 4 + 2$	
	$y = -x - 2$	2
6.4.	$x \cdot f(x) \leq 0$	
	$x \cdot y_f \quad \underline{\leq}$	
	$x \in (-\infty; -4)$ or $[-\frac{5}{2}; 0]$	3
6.5.	$h: \ y = \frac{3}{x+4} + 2$	1
6.6.	$C(-10; 2,5)$	
	$y = -x - 2$	
	$x = -10$ $\qquad$ $y = 2,5$	
	$y = -(-10) - 2$ $\qquad$ $2,5 = -x - 2$	
	$= 8$ $\qquad$ $x = -4,5$	
	$C'(-4,5; 8)$	2

7.



$g: \quad y = x + c$

$f: \quad y = -2x^2 + 5x + 7$

7.1 $f \cap g$:

$-2x^2 + 5x + 7 = x + c$

$-2x^2 + 4x + 7 - c = 0$

$\Delta = (4)^2 - 4(-2)(7-c)$

$= 16 - 4(-14 + 2c)$

$= 16 + 56 - 8c$

$= 72 - 8c$

tan $\Delta = 0$

$72 - 8c = 0$

$-8c = -72$

$c = 9$ 5

7.2. $f(x) = g(x) - 2k + 3$

$f(x) = x + 9 - 2k + 3$

$f(x) = x \underbrace{+12 - 2k}_{y\text{int}}$

$7 < y\text{int} < 9$

$7 < 12 - 2k < 9$

$-5 < -2k < -3$

$\frac{5}{2} > k > \frac{3}{2}$ 3

8.1.

$A = P(1-i)^n$ ✓f

$\frac{1}{4}x \overset{\checkmark \text{sub}}{=} x\left(1-\frac{r}{100}\right)^{15}$

$\div x \quad (x \neq 0)$

$\frac{1}{4} = \left(1-\frac{r}{100}\right)^{15}$

$\sqrt[15]{\frac{1}{4}} = 1-\frac{r}{100}$ ✓

$0{,}91\ldots = 1-\frac{r}{100}$

$r \overset{\checkmark}{=} 8{,}83\ \%$ pa 4

8.2.

$1+i_{ea} = \left(1+\frac{i_{nom}}{k}\right)^k$

$1+i_{ea} \overset{\checkmark}{=} \left(1+\frac{11{,}2}{200}\right)^2$

$i_{ea} \overset{\checkmark}{=} 0{,}115\ldots$

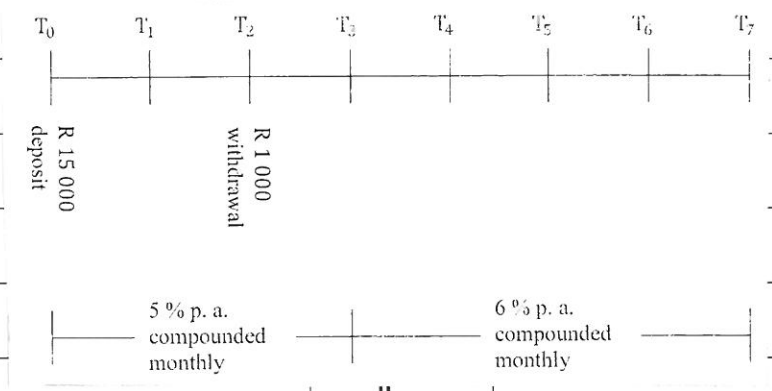
$1+0{,}115\ldots \overset{\checkmark}{=} \left(1+\frac{x}{400}\right)^4$

✓$\sqrt[4]{1{,}115\ldots} = 1+\frac{x}{400}$

$1{,}027\ldots = 1+\frac{x}{400}$

$11{,}05\ \% = x$ ✓ 5

8.3.



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

15000 ✓ ✓

$A = 15000\left(1+\frac{5}{1200}\right)^{36}\left(1+\frac{6}{1200}\right)^{48}$

$= 22\ 134{,}56\ldots$

1000 ✓ ✓

$A = 1000\left(1+\frac{5}{1200}\right)^{12}\left(1+\frac{6}{1200}\right)^{48}$

$= 1\ 335{,}48\ldots$

$\therefore$ Balance

$= R\ 20\ 799{,}08$ ✓ 5

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

$T_0 - T_2 \quad A = 15000\left(1+\frac{5}{1200}\right)^{24}$ ✓

$= 16\ 574{,}12\ldots$

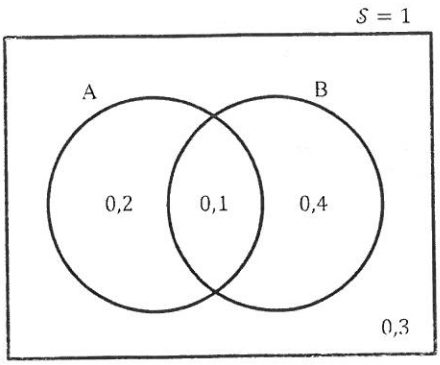
$T_2 - T_3 \quad A \overset{\checkmark}{=} \overset{\checkmark}{15574{,}12\ldots} \overset{\checkmark -1000}{} \left(1+\frac{5}{1200}\right)^{12}$

$= 16\ 370{,}92\ldots$

$T_3 - T_7 \quad A \overset{\checkmark}{=} 16\ 370{,}92\ldots\left(1+\frac{6}{1200}\right)^{48}$

$\overset{\checkmark}{=} R\ 20\ 799{,}08$ 5

9.1.



9.1.1. No, $P(A \cap B) = 0,1$

$\neq 0$ 2

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

$P(A) \times P(B) = 0,3 \times 0,5$

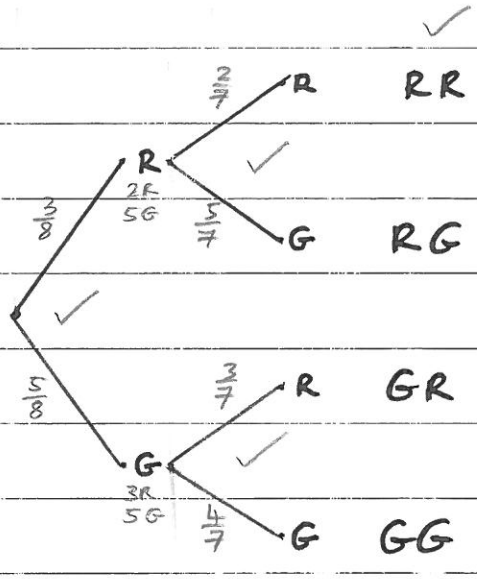
$= 0,15$

condition

$\therefore P(A \cap B) \neq P(A) \times P(B)$

$\therefore$ No 4

9.2.1 3 R 5 G



4

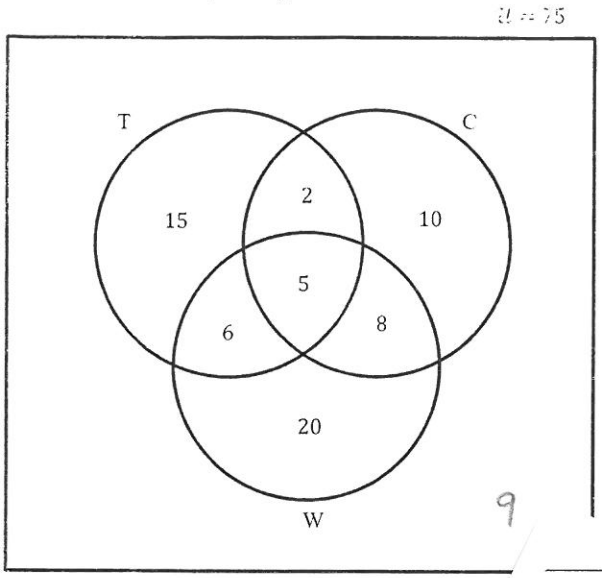
9.2.2. P(RG or GR)

$= \frac{3}{8} \times \frac{5}{7} + \frac{5}{8} \times \frac{3}{7}$

$= \frac{15}{56} + \frac{15}{56}$

$= \frac{15}{28}$ 3

9.3.



9.3.1. (a) $75 - (15+20+10+2+6+5+8)$

$= 75 - 66$

$= 9$ ✓ learners 1

(b) $15 + 10 + 20$

$= 45$ ✓ learners 1

(c) 6 ✓ learners 1

(d) $6 + 2 + 8 + 5$

$= 21$ ✓ learners 1

9.3.2 (a) $P(T \cap C')$

T 15 6 5 2

C' 15 6 20 9

$= \frac{15+6}{75}$

$= \frac{21}{75}$ ✓✓

$= \frac{7}{25}$ 2

(b) $P(T \cup (W \cap C))$

T 15 6 5 2

$W \cap C$ 5 8

$= \frac{15+6+5+2+8}{75}$

$= \frac{36}{75}$

$= \frac{12}{25}$ ✓✓ or 0 2

$\frac{36}{75}$ not simplified 2/2