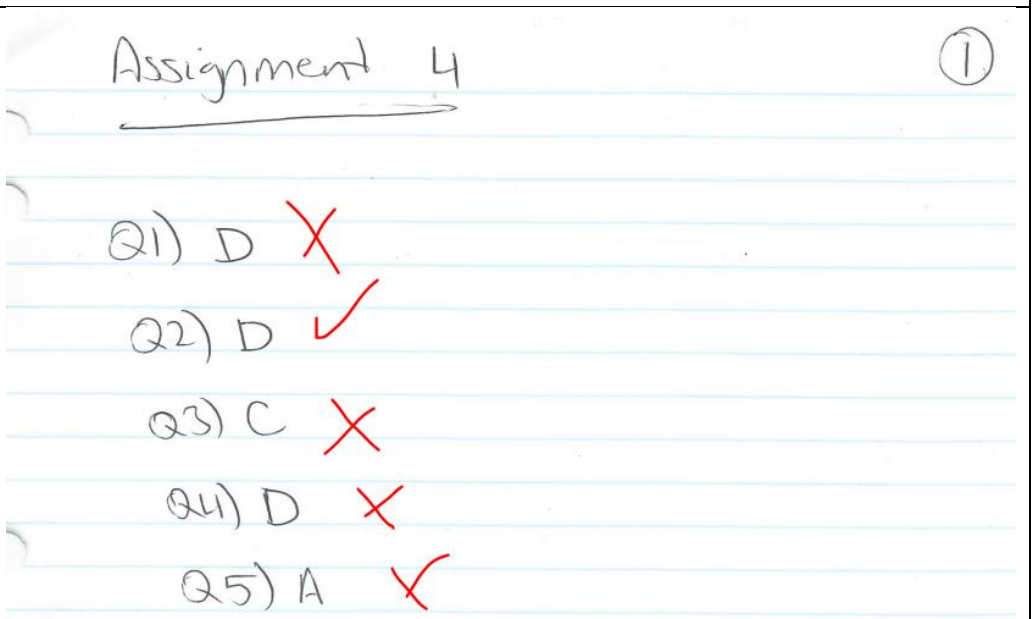
TAFE ID	329428800	Result Slip No	S2512196
Student Name	Rachel Loveday	Date marked	*13/10/2021*

Student Feedback
Mathematics
Assignment 6492MD 4

Result	$\frac{16.5}{48} = 34\ \%$

	Max mark	mark	Teacher's Comments
Q1 to 5			
1	1	0	A
2	1	1	D
3	1	0	A
4	1	0	C
5	1	0	C
			 Rachel, please find my solutions below: **Q1:** $P(5\ or\ 6) = \frac{2}{6}$ $P(N5N6) = \frac{4}{6}$ $P(at\ least\ one\ 5\ or\ 6) = 1 - P(N5N6) = 1 - \frac{4}{6} \times \frac{4}{6} = \frac{36-16}{36} = \mathbf{\frac{20}{36}} \therefore \mathbf{A}$

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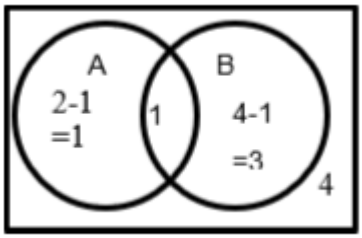
			Q3: The derivative of e^x is e^x and the derivative of $e^{f(x)}$ is $e^{f(x)} \times f'(x)$. $(5e^{3x-1})' = 5 \times e^{3x-1} \times 3 = 15\, e^{3x-1}$ ∴ **A** **Q4**: $If\ P(A) = \frac{2}{9}\ and\ P(B) = \frac{4}{9}\ and\ P(A \cap B) = \frac{1}{9}$, what is $P(A \cup B)$? $P(A \cup B) = P(A) + P(B) - P(A \cap B) = \frac{2}{9} + \frac{4}{9} - \frac{1}{9} = \frac{5}{9}$ ∴ **C** **You may create a Venn diagram to represent A and B:**  **Q5:** Conditional probability: $P(X\|Y) = \frac{P(X \cap Y)}{P(Y)} = \frac{\frac{10}{50}}{\frac{42}{50}} = \frac{10}{42}$ ∴ **C**
total	5	1	
Q6			
a	2	2	Correct answer
b	2	1	Correct answer
c	2	1	Correct answer
d	1	1	Correct answer

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Q6) 4 black balls + 3 white balls = 7 balls

a) Probability of first ball being white is $\frac{3}{7}$ ✓

$P(W_1) = \frac{3}{7}$

After taking the first ball out, there are six balls left: 4 black and 2 white

$P(W_2) = \frac{2}{6} = \frac{1}{3}$ ✓

Q6)
a) (Continued)

Probability of both balls being white

$P(W_1 \cap W_2) = \frac{3}{7} \times \frac{1}{3}$ ✓

$= \frac{3}{21}$

$= \frac{1}{7}$ ✓

b) Probability of first ball being white is $\frac{3}{7}$

$P(W) = \frac{3}{7}$

After the first ball is drawn, 6 balls remain: 4 black and 2 white. ✓

$P(B) = \frac{4}{6} = \frac{2}{3}$

$P(W \cap B) = \frac{3}{7} \times \frac{2}{3}$

$= \frac{6}{21} = \frac{2}{7}$

How about P(B, W)

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b)

$$\begin{aligned} \mathrm{P}(\text{white and black}) &= P(WB \text{ or } BW) \\ &= \frac{3}{7}\times\frac{4}{6}+\frac{4}{7}\times\frac{3}{6} \\ &= \frac{12}{42}+\frac{12}{42} \\ &= \frac{24}{42} \\ &= \frac{4}{7} \end{aligned}$$

(3)

(Qb)
c) Probability of both balls being white was proven in (a) to be $\frac{1}{7}$ ✓

$P(\text{Both White}) = \frac{1}{7}$

Probability of first ball being black is $\frac{4}{7}$

$P(B_1) = \frac{4}{7}$

After the first ball is drawn, 3 black balls and 3 white balls are left.

$P(B_2) = \frac{3}{6} = \frac{1}{2}$

$P(\text{Both Black}) = \frac{4}{7} \times \frac{1}{2}$

$= \frac{4}{14} = \frac{2}{7}$ ✓

$\therefore P(\text{Same Colour}) = \frac{1}{7} \times \frac{2}{7}$ ✗

$= \frac{2}{49}$ ✗

$P(WW) + P(BB) = \frac{1}{7} + \frac{2}{7} = \frac{3}{7}$

c) Rachel, you may do this using probability of complimentary event:

$\mathrm{P}(\text{same}) = 1 - \mathrm{P}(\text{different}) = 1 - \frac{4}{7} = \frac{3}{7}$

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			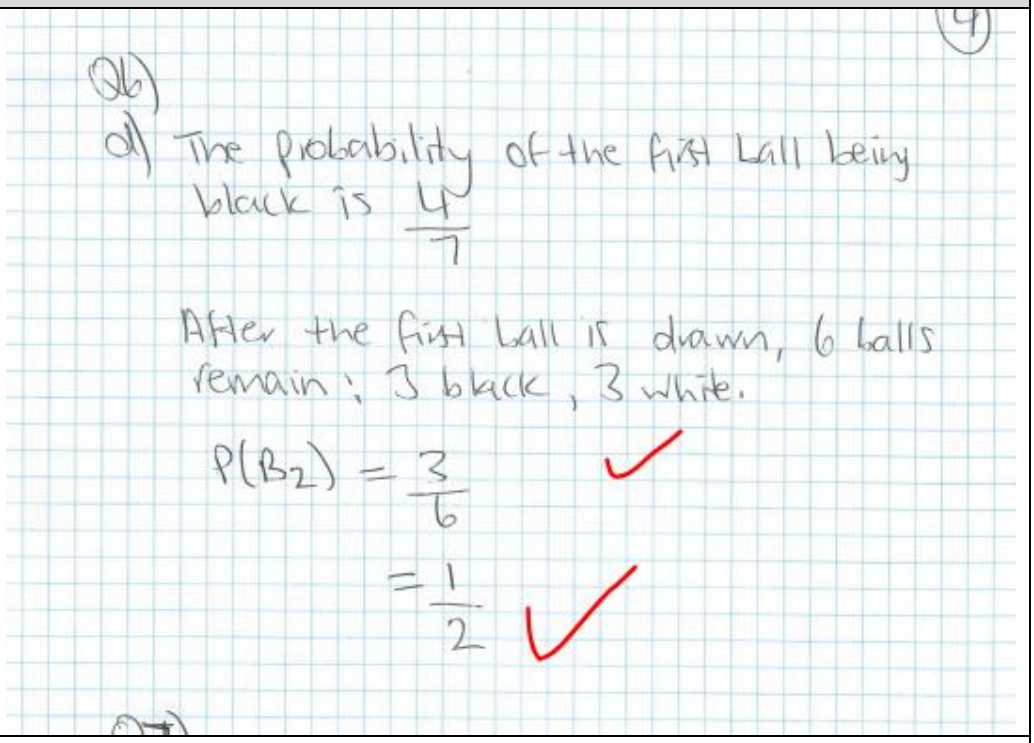
Q6 total	7	5	
Q7			
a	1	1	Correct probability of not pink flower
b	2	0	Correct probability
c	1	0	Sets up inequality
	1	0	Solves the inequation
	1	0	Correct answer for *n*

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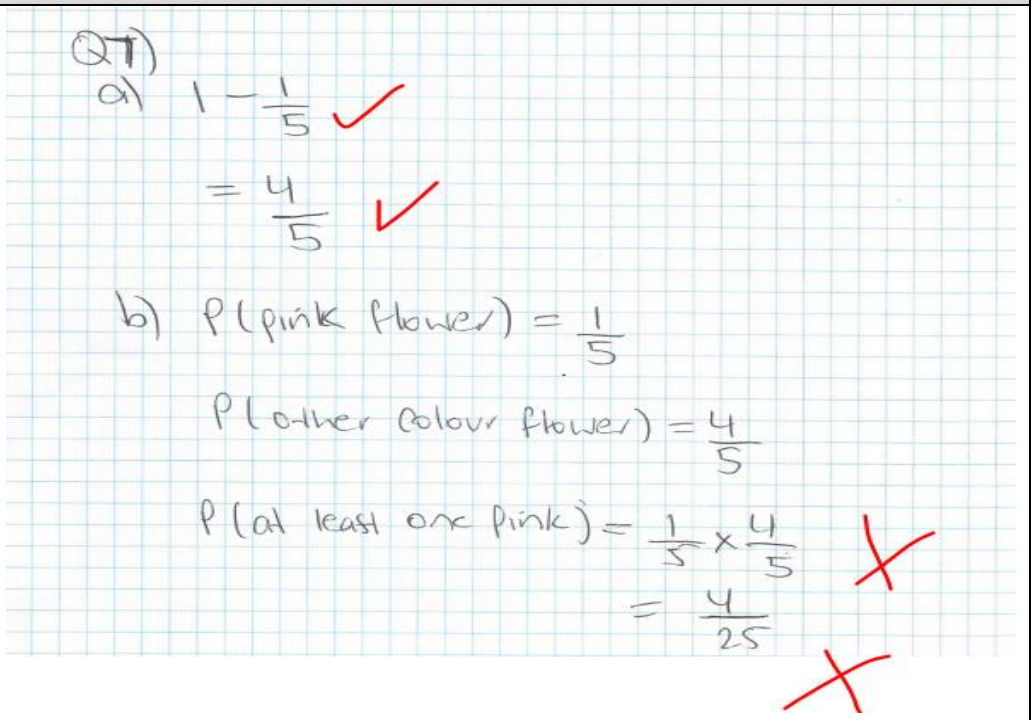
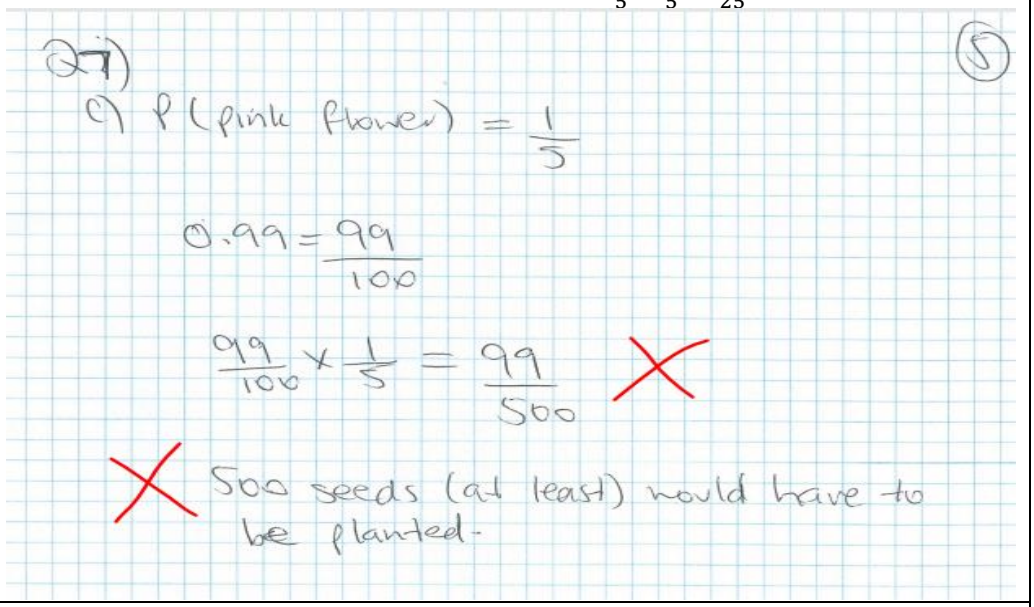
			 b) Rachel, use the probability of the complementary event: b) P (at least one pink) $= 1 - \text{P(N, N)} = 1 - \frac{4}{5} \times \frac{4}{5} = \frac{9}{25}$ 
			c) This part will lead to an inequality where the unknown is in the exponent. To solve it, you will need to use logarithms.

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			$P(\text{pink}) = \frac{1}{5}$ $P(\text{not pink}) = 1 - \frac{1}{5} = \frac{4}{5}$ $\text{P}(\text{at least one pink}) = 1 - \text{P}(\text{no pinks})$ $= 1 - \left(\frac{4}{5}\right)^n$ $1 - \left(\frac{4}{5}\right)^n > 0.99$ $\left(\frac{4}{5}\right)^n < 0.01$ $\ln\left(\frac{4}{5}\right)^n < \ln 0.01$ $n \ln\left(\frac{4}{5}\right) < \ln 0.01$ $n > \frac{\ln 0.01}{\ln\left(\frac{4}{5}\right)}$ $n > 20.637...$ $21 \text{ seeds need to be planted}$
Q7 total	6	1	
Q8			
a	1	1	Correct answer
b	1	1	Correct answer
c	2	2	Correct answer
d	2	0.5	Correct answer

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	Max mark	mark	Teacher's Comments

Q8) (6)

a) $\frac{4}{30} = \frac{2}{15}$ ✓

b) For this question "defective" = D

$P(D_1) = \frac{2}{15}$ ✓

When one globe is picked, 29 remain: 26 non-defective and 3 defective.

$P(D_2) = \frac{3}{29}$ ✓

$P(D_1 \cap D_2) = \frac{2}{15} \times \frac{3}{29}$ ✓

$= \frac{6}{435}$

$= \frac{2}{145}$ ✓

c) 30 light globes: 26 non-defective and 4 defective.

For this question = non-defective" = N

$P(N_1) = \frac{26}{30} = \frac{13}{15}$ ✓

When one globe is picked, 29 remain: 25 non-defective and 4 defective.

Q8) (7)

c) (Continued)

$P(N_2) = \frac{25}{29}$

$P(N_1 \cap N_2) = \frac{13}{15} \times \frac{25}{29}$ ✓

$= \frac{325}{435}$

$= \frac{65}{87}$ ✓

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			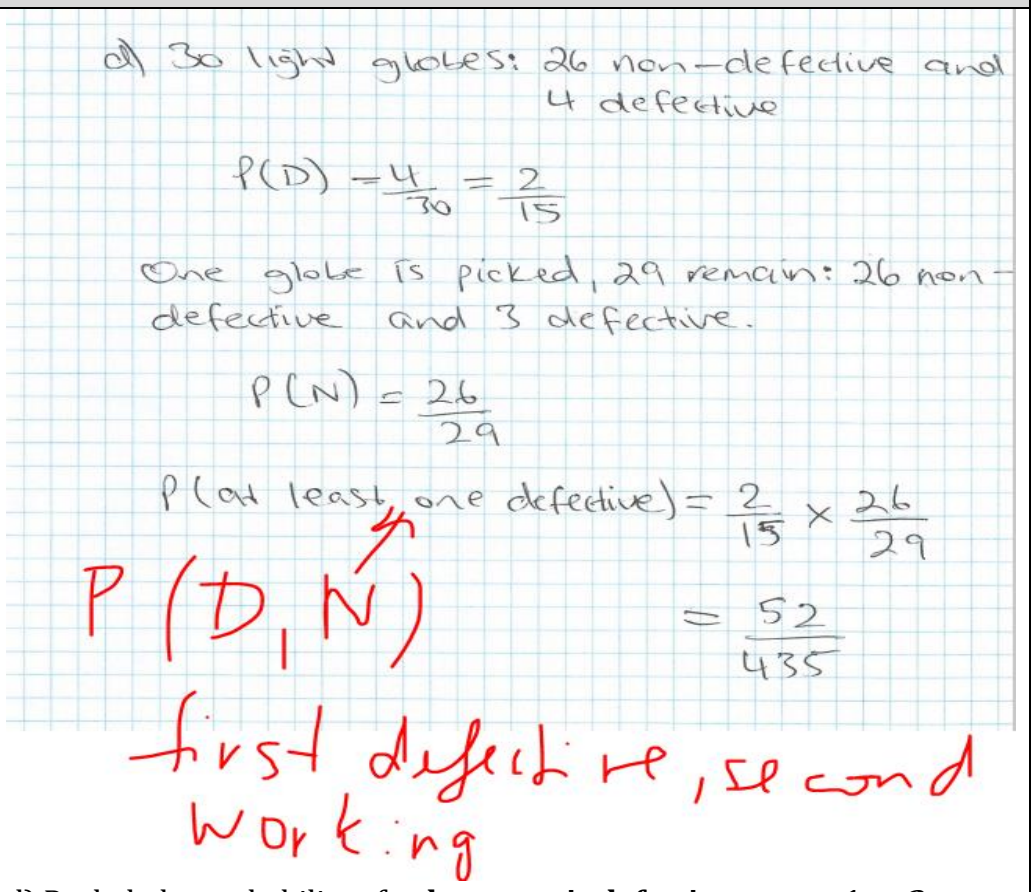 d) Rachel, the probability of a**t least one is defective means 1 or 2 defective** since all the possibilities are: 0, 1 or 2 Defective. First solution: $P(DN) + P(ND) + P(DD) = \frac{4}{30} \times \frac{26}{29} + \frac{26}{30} \times \frac{4}{29} + \frac{4}{30} \times \frac{3}{29} =$ $\frac{104}{870} + \frac{104}{870} + \frac{12}{870} = \frac{220}{870} = \frac{22}{87}$ I like using the following method: **The complementary event: 0 defective is NN.** Use the answer from part c. $P(at\ least\ one\ defective) = P(no\ defective) = 1 - P(NN) =$ $1 - \frac{65}{87} = \frac{22}{87}$
Q8 total	6	4.5	

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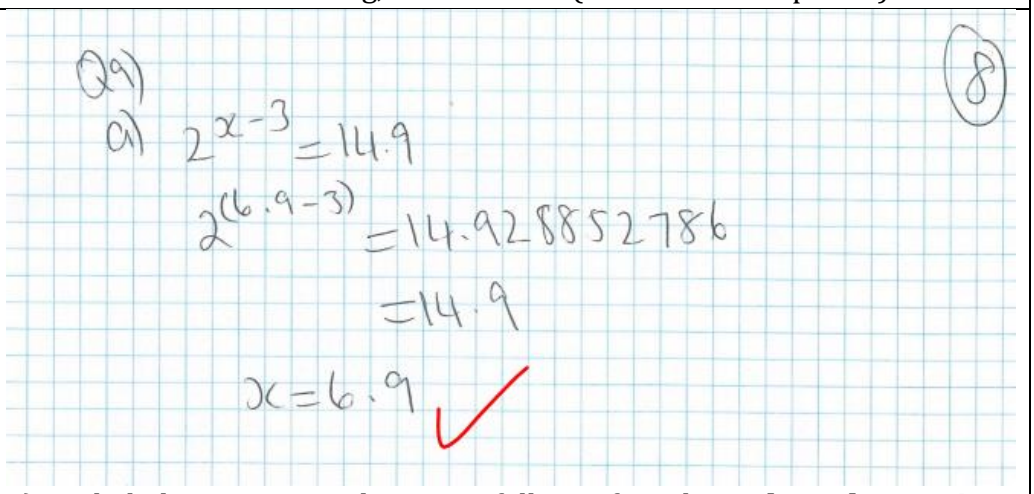
	Max mark	mark	Teacher's Comments
Q9			
a	2	2	1 for some correct working, 1 for answer (to one decimal place)
b	2	0	1 for some correct working, 1 for answer
c	2	0	1 for some correct working, 1 for answer
d	2	0	1 for some correct working, 1 for answer (to two decimal places)
			 **a)** Rachel, the correct working is as follows if you have **the unknown in the exponent:** **take the logarithm of both sides,** it can be e-based or 10-based as these are on the scientific calculator, normally e- based is used. Then use the 3rd log rule: $log_a\, x^n = n\, log_a\, x$ (The exponent n becomes a factor.) $2^{x-3} = 14.9$ $\ln 2^{x-3} = ln\ 14.9$ $(x-3)\ln 2 = \ln 14.9$ $x = \frac{\ln 14.9}{\ln 2} + 3$ $x = 6.9\ (1dp)$ You may change the index form to logarithmic form, then we need to use the change of base formula so we may calculate its value using the natural based ln key on a scientific calculator:

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$2^{x-3} = 14.9$

$x - 3 = \log_2 14.9$

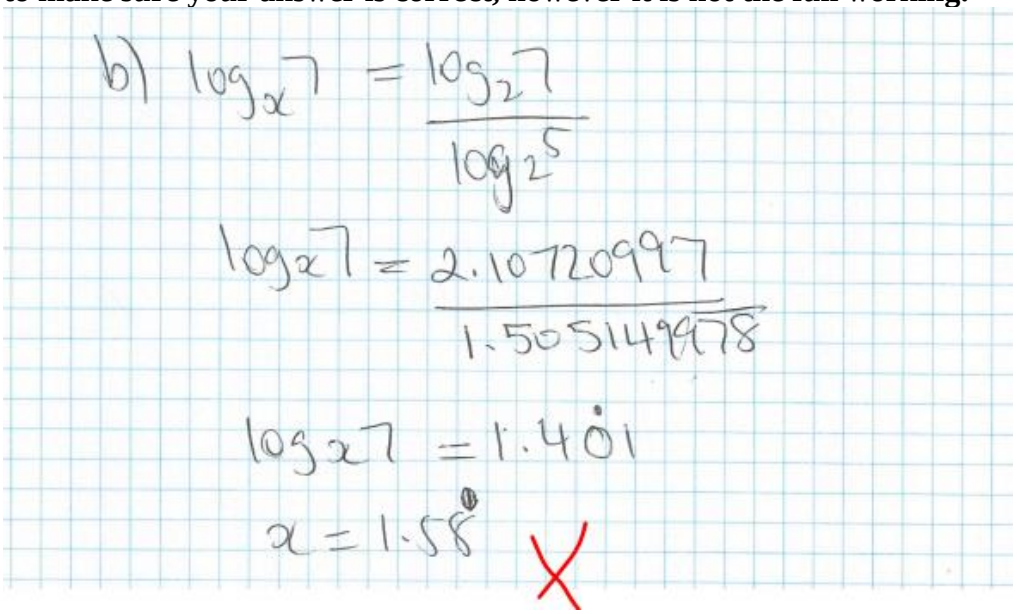
$x = \log_2 14.9 + 3$

$x = \dfrac{\ln 14.9}{\ln 2} + 3$

$x = 6.8972...$

$x = 6.9$

Rachel, I gave you the full marks for part *a* but really you just substituted the value of x and showed it was correct, checking the answer can be done to make sure your answer is correct, however it is not the full working.



b)

Use the change of base formula: $\log_a b = \frac{\log_c b}{\log_c a}$

$\dfrac{\log_2 7}{\log_2 5} = ?$

Since $a = 5, b = 7$ *and* $c = 2$:

$\dfrac{\log_2 7}{\log_2 5} = \log_5 7$

$\log_x 7 = \log_5 7$

The base must be the same:

$x = 5$

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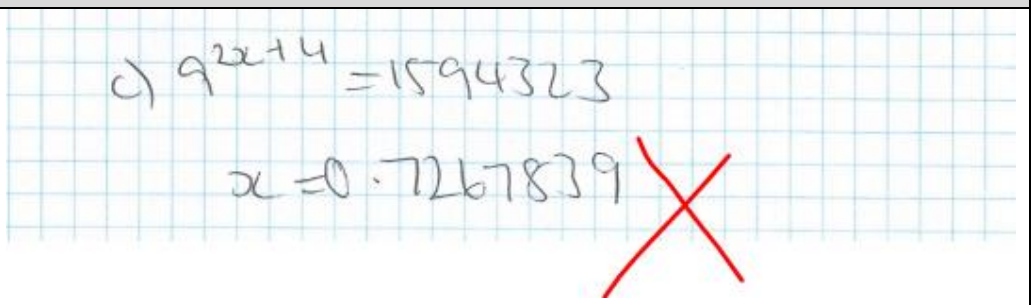
	Max mark	mark	Teacher's Comments



c) Using logarithms, similarly to part *a* either by taking the logarithm of both sides or changing the index form to logarithmic form and using the 3rd log rule: $log_a\, x^n = n\, log_a\, x$ the exponent becomes a factor:

$$9^{2x+4} = 1594323$$
$$\ln 9^{2x+4} = \ln 154323$$
$$(2x+4) \times \ln 9 = \ln 154323$$
$$2x + 4 = \frac{\ln 154323}{\ln 9}$$
$$x = \frac{\frac{\ln 154323}{\ln 9} - 4}{2}$$

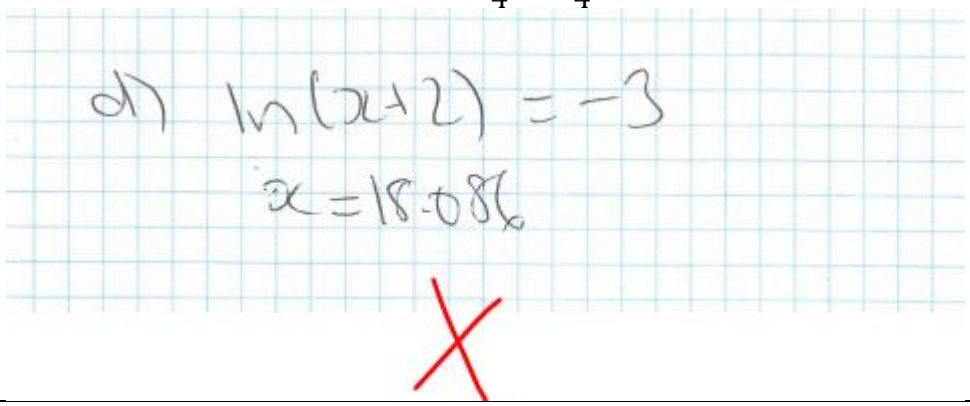
$$x = 1.25$$

c)
You may notice that $1594323 = 3^{13} or\ 9^{6.5}$ and then you can solve this question without logarithms:

$$(3^2)^{2x+4} = 3^{13}$$
$$3^{4x+8} = 3^{13}$$

If the bases are the same, the exponents must be the same too:

$$4x + 8 = 13$$
$$x = \frac{5}{4} = 1\frac{1}{4}$$



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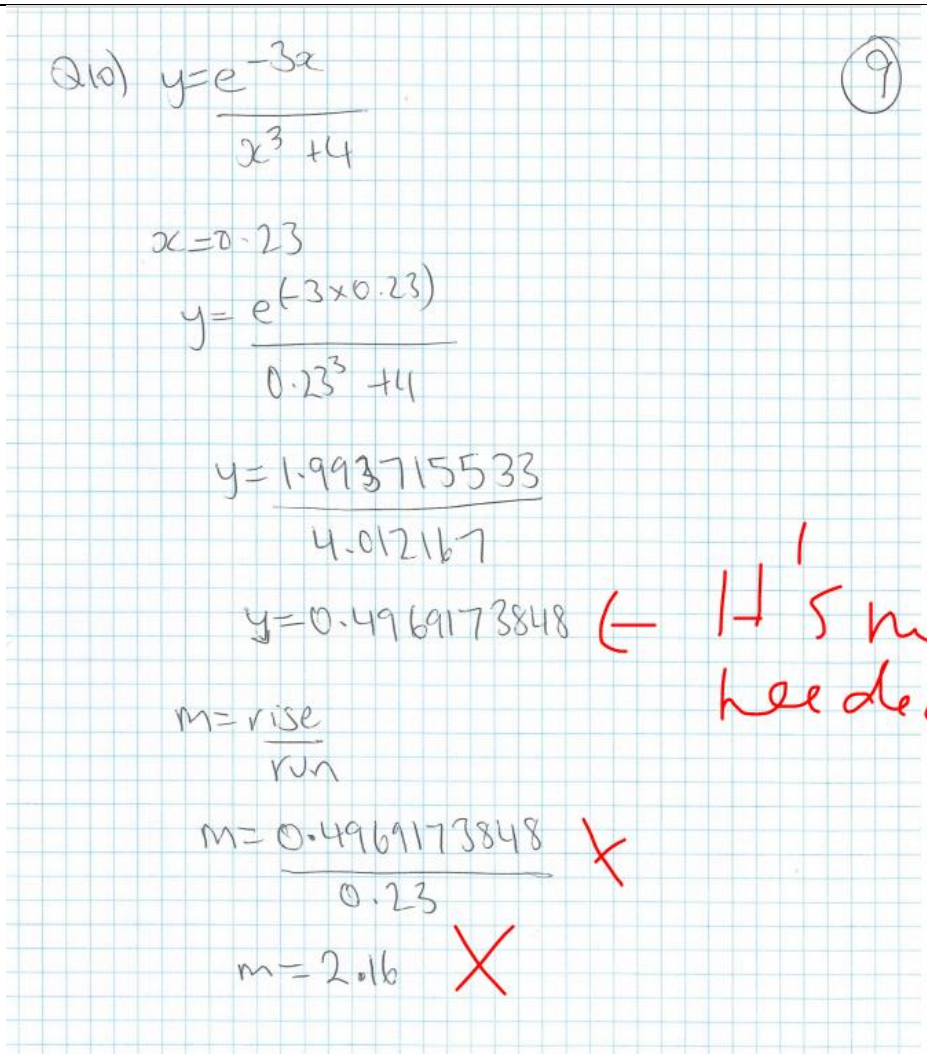
	Max mark	mark	Teacher's Comments
			d) To solve this equation, you need to change the logarithmic form to index form: $\ln(x+2) = -3$ $e^{-3} = x + 2$ Subtract 2 from both sides to find x on its own: $e^{-3} - 2 = x$ Use your calculator to find the value of x: $x = -1.95\ (2\ dp)$
Q9 total	8	2	
Q10			
	3	0	2 for correct working, 1 for answer
	1	0	substitution
			

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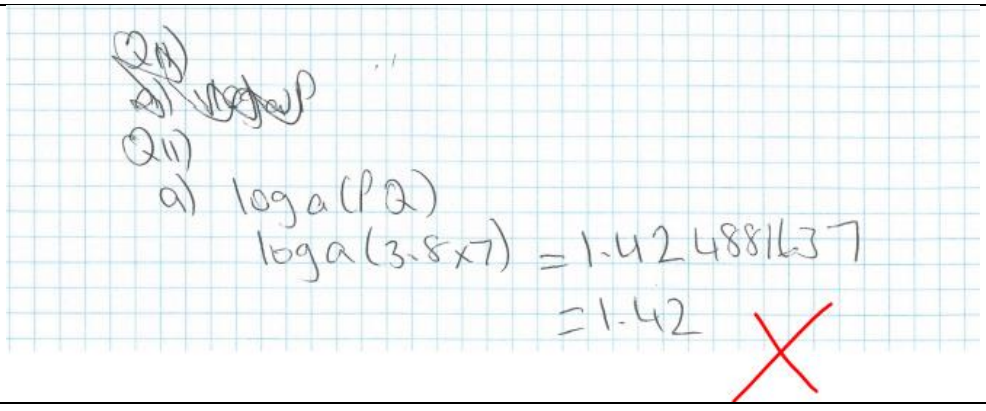
			$\frac{dy}{dx} = \frac{(x^3+4)(-3e^{-3x}) - (e^{-3x})(3x^2)}{(x^3+4)^2}$ $= \frac{-3x^3e^{-3x} - 12e^{-3x} - 3x^2e^{-3x}}{(x^3+4)^2}$ $\frac{dy}{dx} = \frac{-3e^{-3x}(x^3+x^2+4)}{(x^3+4)^2}$ $x = 0.23 \Rightarrow \frac{dy}{dx} = \frac{-3e^{-3(0.23)}[(0.23)^3+(0.23)^2+4]}{[(0.23)^3+4]^2}$ $= \frac{(-1.5047...)(4.065067)}{(16.09748...)}$ $= -0.379986.....$ $= -0.38$
Q10 total	4	0	
Q11			
a	2	0	Correct log rule 1 mark, 2 marks for correct answer
b	2	0	Correct log rule 1 mark, 2 marks for correct answer
c	2	0	Correct log rule 1 mark, 2 marks for correct answer
			

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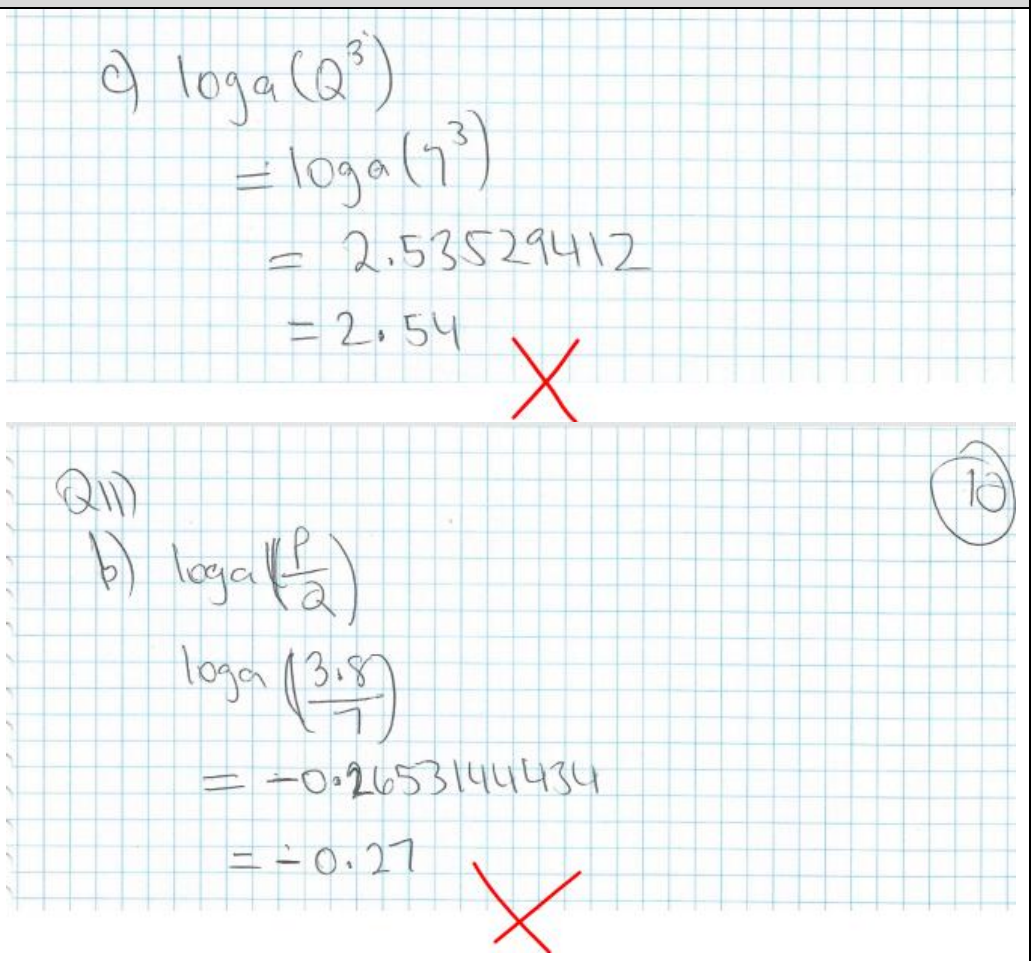

Rachel, use the log rules to solve these questions:

1st log rule: $\boldsymbol{log_a\,(xy) = log_a\,x + log_a\,y}$

2nd log rule: $\boldsymbol{log_a\left(\frac{x}{y}\right) = log_a\,x - log_a\,y}$

3rd log rule: $\boldsymbol{log_a\,x^n = n\,log_a\,x}$

These are given: $\boldsymbol{log_a\,P = 3.8}$ and $\boldsymbol{log_a\,Q = 7}$.

a) Use the 1st log rule:
$log_a\,(PQ) = log_a\,P + log_a Q = 3.8 + 7 = 10.8$

b)
Use 2nd log rule: $log_a\left(\frac{P}{Q}\right) = log_a\,P - log_a\,Q = 3.8 - 7 = -3.2$

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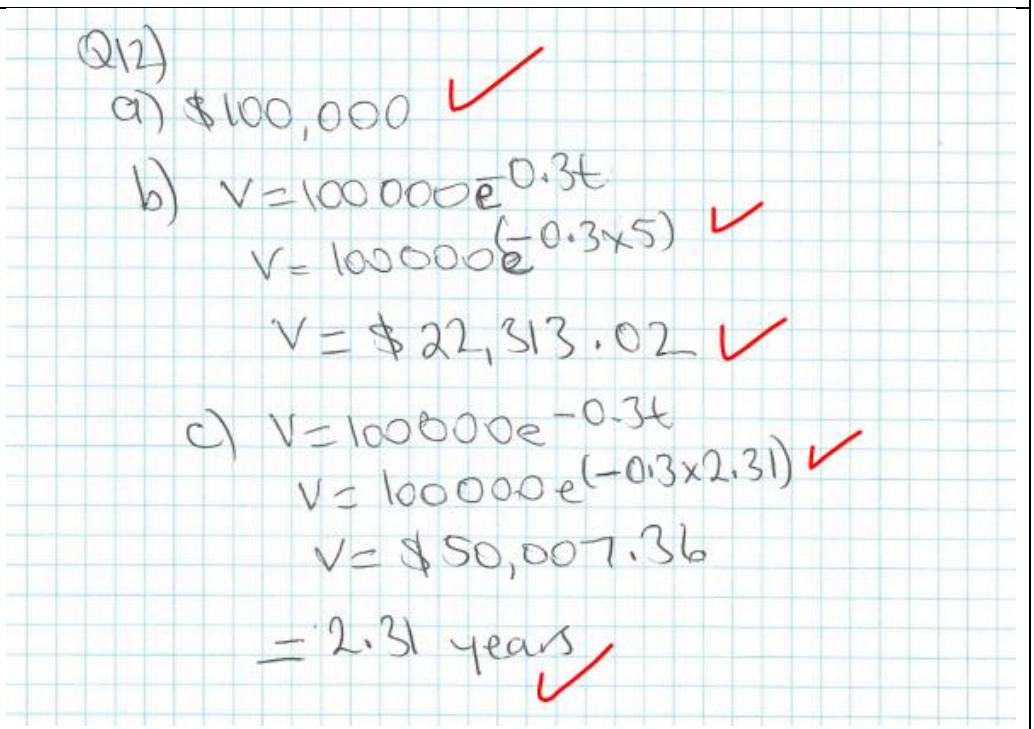
	Max mark	mark	Teacher's Comments
			c) Use the 3rd log rule: $log_a\ Q^3 = 3\ log_a\ Q = \ 3 \times 7 = 21$
Q11 total	6	0	
Q12			
a	1	1	Correct answer
b	1	1	1 substitution 1 solution
c	2	1	Solve equation for t, (1 mark for correct step)
d	2	0	1 derivative 1 value
			 Rachel, your working is insufficient. You need to state the values of t in parts *a* and *b*. Part *c* again, has no working, it seems you solve the equations with the unknown in the exponent using the guess and check method. This level of maths requires you to recognise when the unknown is in the exponent, you need to solve these using logarithms. Part d: when there is a 'rate' in the question, you must differentiate. **a) The original value refers to $t = 0$, find v:** $v = 100000\ e^{-0.3t} = 100000 \times e^{-0.3\times0} = 100000 \times e^0 = \$100\ 000$ **b) Find v when $t = 5$ years.**

	Max mark	mark	Teacher's Comments

$v = 100000e^{-0.3t} = 100000 \times e^{-0.3\times5} = 100000 \times e^{-1.5} = 22\,313.01601$

The value of the equipment in 5 years is \$22 313.02 (to nearest cent).

c) 50% of the original value of 100 000 is \$50 000.

$50\,000 = 100000\,e^{-0.3t}$ Solve this equation for t.

First divide both sides by 100 000:

$$\frac{50000}{100000} = e^{-0.3t}$$

$$\frac{1}{2} = e^{-0.3t}$$

Write it in logarithmic form:

$$\ln\frac{1}{2} = -0.3\,t$$

Divide both sides by -0.3:

$$t = \frac{\ln\frac{1}{2}}{-0.3}$$

Enter it in your calculator to find the value of t:

$$t = 2.31049\ldots$$

The time it takes to reach 50% of resale value is about 2.31 ($2dp$) years.

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			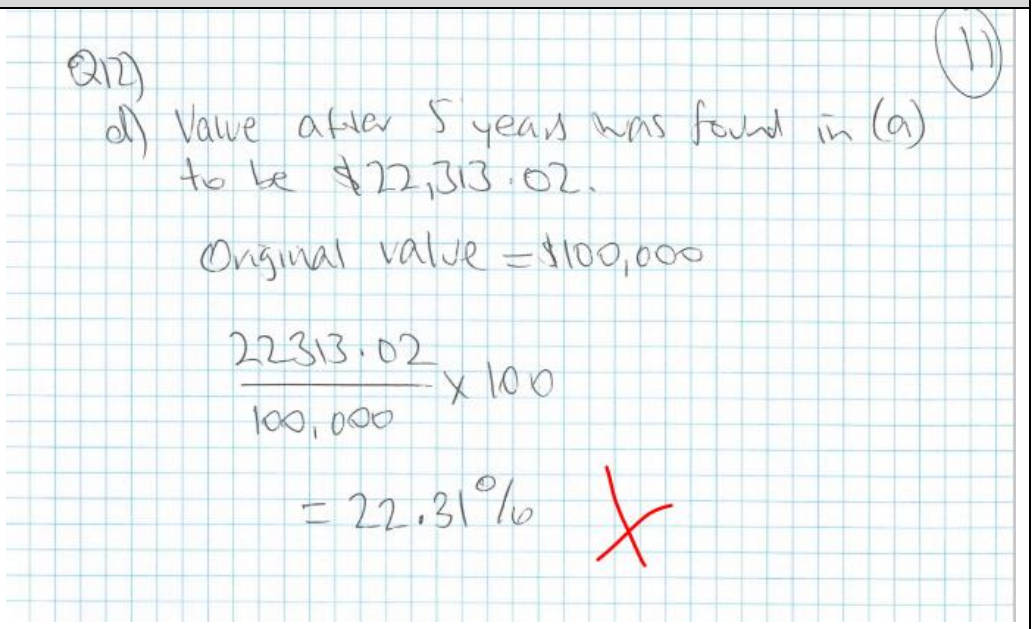 d) Find the rate of depreciation $\frac{dv}{dt}$ after five years: First differentiate v with respect to t: $\frac{dv}{dt} = -0.3 \times 100000\, e^{-0.3t} = -30\,000e^{-0.3t}$ This is the instantaneous rate of change at time t in general. Now find the rate when $t = 5$ years: $\frac{dv}{dt} = -30\,000 \times e^{-0.3\times5} = -30\,000 \times e^{-1.5} = -6693.904804$ Note the instantaneous **rate of change is negative (the rate of increase as well)** but **the rate of reduction is positive** here it is called **rate of depreciation:** +$6693.90 per year. Further, if you had a negative rate of depreciation, it would mean the equipment appreciated.
Q12 total	6	3	

Teacher's Comment
Rachel,

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This course has Calculus and to study this level of maths requires a real good understanding of algebraic manipulations.

As discussed, I am giving you the solutions with my feedback.

Regards,

Anna Fazekas
Maths Teacher