1. Unit One Mark: 95/ 112 = 85%

5/5 a)

$$(2x^3)(-7x^5) = -14x^8$$

b)

$$\frac{-45x^5y^7z^9}{9x^7y^7z^5} = \frac{-5z^2}{x^2}$$

c)

$$(-5x^4)^3 = (-5)^3x^{12} = -125x^{12}$$

d)

$$\frac{(3x^4y^5z^7)^5}{(-3x^3yz^4)^7} = \frac{3^5x^{20}y^{25}z^{35}}{(-1)^7 3^7 x^{21}y^7z^{28}} = \frac{y^{18}z^7}{-9x}$$

e)

$$\frac{\left(x^{a+b}\right)^{a-b}}{(x^{a-2b})^{a+2b}} = \frac{x^{a^2-b^2}}{x^{a^2-4b^2}} = x^{a^2-b^2-a^2+4b^2} = x^{3b^2}$$

2. 4/4 a)

$$6^{-2} = \frac{1}{6^2} = \frac{1}{36}$$

b)

$$25^{\frac{3}{2}} = 5^3 = 125$$

c)

$$-8^{\frac{5}{3}} = -2^5 = -32$$

d)

$$625^{-\frac{3}{4}} = \frac{1}{625^{\frac{3}{4}}} = \frac{1}{5^3} = \frac{1}{125}$$

3. 6/6 a)

$$9^3 27^2 81^3 = (3^2)^3(3^3)^2(3^4)^3 = 3^6 3^6 3^{12} = 3^{24}$$

b)

$$\frac{5^7 25^3}{125^4} = \frac{5^7(5^2)^3}{(5^3)^4} = \frac{5^7 5^6}{5^{12}} = \frac{5^7}{5^6} = 5$$

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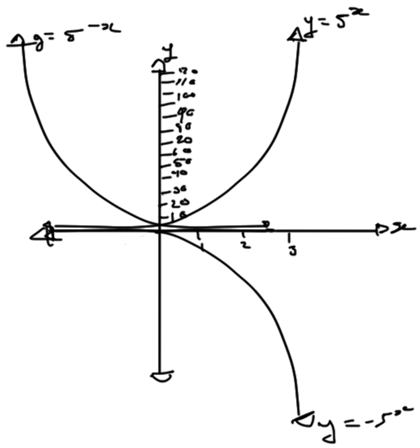

4. 3/3, but you should use graph paper!!
5. 2/2

$$y = -3^{-x}$$

6. 3/3

$$75\ g = (2400\ g)\left(\frac{1}{2}\right)^{\frac{t}{13.8\ s}}$$
$$\frac{75}{2400} = \frac{1}{32} = \frac{1}{2^5} = \left(\frac{1}{2}\right)^5 = \left(\frac{1}{2}\right)^{\frac{t}{13.8\ s}}$$
$$5 = \frac{t}{13.8\ s}$$
$$t = 69\ s$$

The beryllium-11 will take 69 seconds to decompose to 75 grams.

7. 3/3

$A = P(1+i)^n = (\$20000)\big(1+(-0.3)\big)^5 = (\$20000)(0.7)^5 = (\$20000)0.16807 = \$3361.40$

After five years, this car will be worth about $3360.

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8. 6/6 a)

$$\log_6 36 = 2$$

b)

$$\log_6\left(\frac{1}{36}\right) = -2$$

c)

$$7^{\log_7 12} = 12$$

d)

$$\log_{16} 8 = \frac{3}{4}$$

e)

$$\log_3 81\sqrt{27} = \log_3 3^4 3^{\frac{3}{2}} = \log_3 3^{\frac{11}{2}} = \frac{11}{2}\log_3 3 = \frac{11}{2}$$

f)

$$\log_{\frac{1}{3}} 1 = 0$$

9. 3/3 a)

$$\log_7 x = 2$$
$$x = 7^2 = 49$$

b)

$$\log_x 64 = 3$$
$$x = \sqrt[3]{64} = 4$$

c)

$$\log_3(2x - 1) = 3$$
$$2x - 1 = 3^3 = 27$$
$$2x = 28$$
$$x = 14$$

10. 3/3 a)

$$\log_8 2 + \log_8 32 = \log_8(2\times 32) = \log_8 64 = 2$$

b)

$$\log_5 150 - \log_5 6 = \log_5\left(\frac{150}{6}\right) = \log_5 25 = 2$$

c)

$$\log_5 20 + \log_5 10 - 3\log_5 2 = \log_5 \frac{20(10)}{2^3} = \log_5 25 = 2$$

11. 3/3

$$A = P(1 + 1)^n$$
$$\$6000 = \$3000(1 + 0.06)^n$$
$$2 = 1.06^n$$
$$n = \log_{1.06} 2 \cong 11.90$$

It would take 11.9 years for this GIC to grow to $6000.

12. 3/3

$$10^{M_2 - 6.1} = 2$$
$$M_2 - 6.1 = \log 2$$
$$M_2 \cong 0.30 + 6.1 = 6.4$$

The rating on an earthquake that is twice as powerful is 6.4 on the Richter scale.

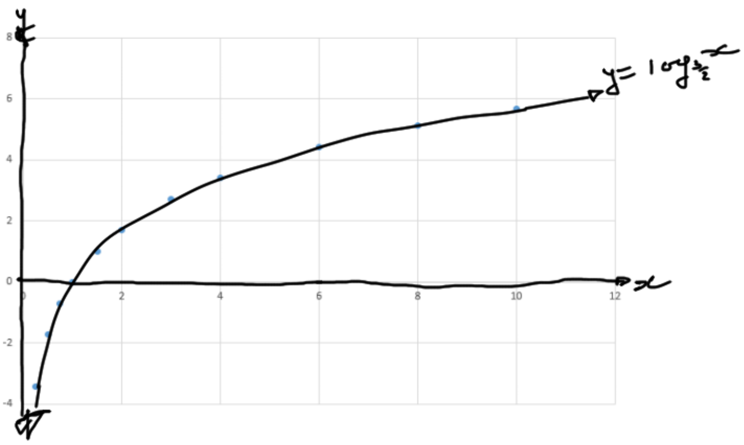
13. 2/2

$$10^x = 50$$
$$10^2 = 100$$
$$10^{1.8} \cong 63.10$$
$$10^{1.7} \cong 50.12$$
$$10^{1.69} \cong 49.00$$
$$10^{1.696} \cong 49.66$$
$$10^{1.698} \cong 49.89$$
$$10^{1.699} \cong 50.00$$
$$\therefore \log 50 \cong 1.699$$

14. 2/3 Domain, range, asymptote? Use a ruler!!!!

X	Y
0.25	-3.42

0.5	-1.71
0.75	-0.71
1	0
1.5	1
2	1.71
3	2.71
4	3.42
6	4.42
8	5.13
10	5.68



15. 2/2 The equation $y = -x + b$ is its own inverse because if one were to make an inverse of the function, they would receive a horizontal and vertical reflection that is coherent to the equation. For the algebraic proof, it is shown below:

$$y = f(x) = -x + b$$
$$x = -f^{-1}(x) + b$$
$$f^{-1}(x) + x = b$$
$$f^{-1}(x) = -x + b$$

This would also be seen in the graph where the equation, when reflected on both axis's regardless of the value of *b*, the slope of *x* is never affected.

16. 3/5 a) i) Reflection in the *x*-axis.
    ii) Reflection in the *y*-axis.
    iii) Reflection in the *x* and *y*-axis.

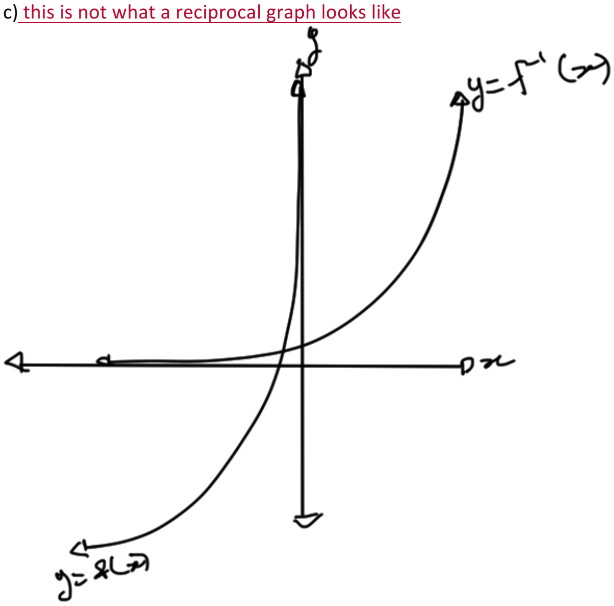
b)

$$y = f(x) = -\log_5(-x)$$
$$x = -\log_5\left(-f^{-1}(x)\right)$$

$-f^{-1}(x) = -5^x$ exponent is -x

$$f^{-1}(x) = 5^x$$

c) this is not what a reciprocal graph looks like



17. 3/4

	$y = -\frac{1}{4}(2)^{x-4} + 5$
Shape	Decreasing
Vertical stretch factor	$\frac{1}{4}$
Point	$(4, 4.75)$
Domain	$D = \{x \epsilon \mathbb{R}\}$
Range	$R = \{y \epsilon \mathbb{R}, y < 5\}$
Asymptote	$y = 5$

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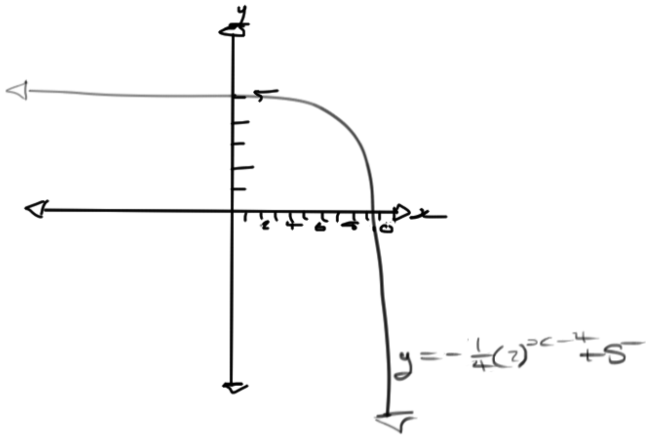
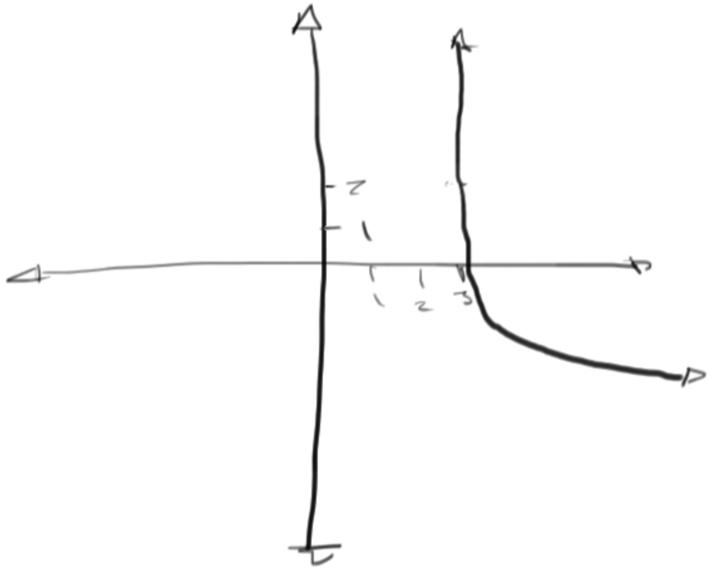


18. 2/2

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

19. 1/2 You cannot submit graphs like this in a 12U math course. You need to use graph paper!!



20. 3/4, your graphs need to display more x values, you can't see the asymptote

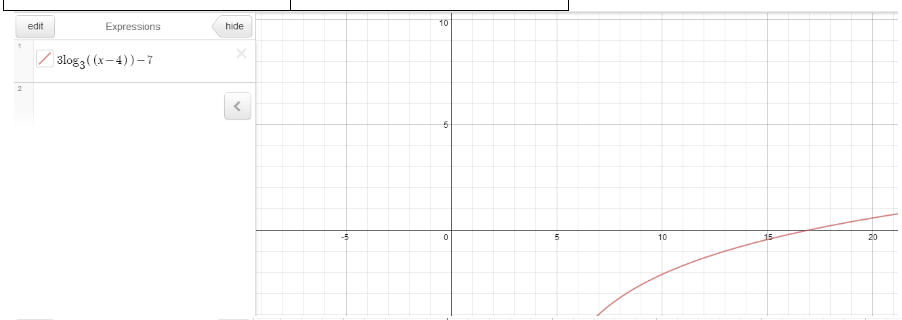
$$y = \frac{1}{5}\log_3(9x-36)^{15} - 13$$
$$= 3\log_3(9x-36) - 13 \quad (LLP)$$
$$= 3\log_3\left(3^2(x-4)\right) - 13$$
$$= 3\log_3 3^2 + 3\log_3(x-4) - 13 \quad \text{(LLM)}$$

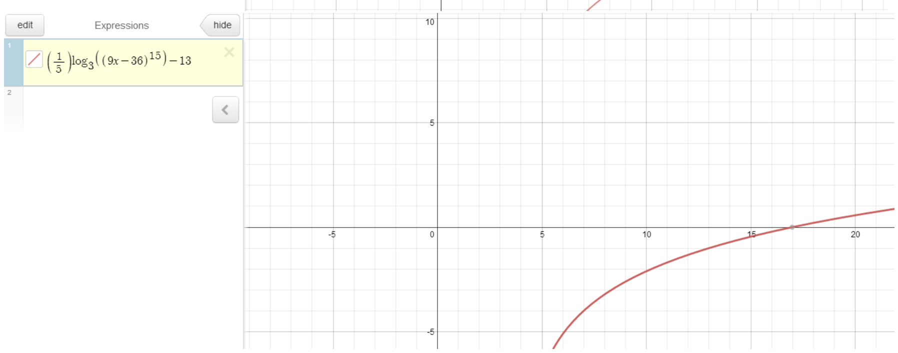
$$= 6 + 3\log_3(x-4) - 13$$
$$= 3\log_3(x-4) - 7$$

The basic equation was $y = \log_3 x$. The transformations applied in order are:

a. Translated 4 units to the right. yes
b. Vertically stretched by a factor of 3.
d. Translated 7 units down. yes

Equation	$y = 3\log_3(x-4) - 7$ yes
Domain	$\{x\epsilon\mathbb{R}, x > 4\}$
Range	$\{y\epsilon\mathbb{R}\}$
Asymptotes	$y = 4$
x-intercepts	$0 = 3\log_3(x-4) - 7$ $7 = 3\log_3(x-4)$ $\frac{7}{3} = \log_3(x-4)$ $x - 4 = 3^{\frac{7}{3}}$ $x = 3^{\frac{7}{3}} + 4$
Vertical Stretch/Compression	3





21. 1/2

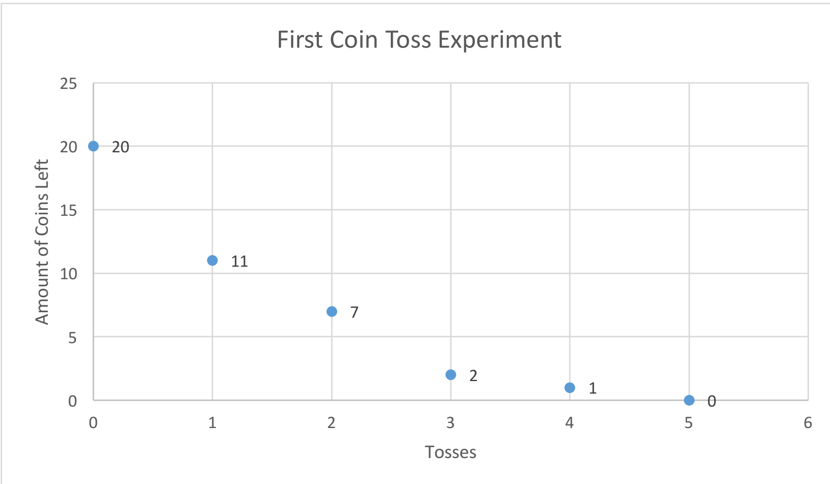
$$y = 1000(10^x) = 10^3 10^x = 10^{x+3}$$

The horizontal translation that makes $y = 10^{x+3}$ is a horizontal translation of 3 units left. Reread the question, should be to the right

22. 9/9 a)

Toss	Coins
0	20
1	11
2	7
3	2
4	1
5	0

b) i)



ii)

$$y = 20(0.5)^x$$

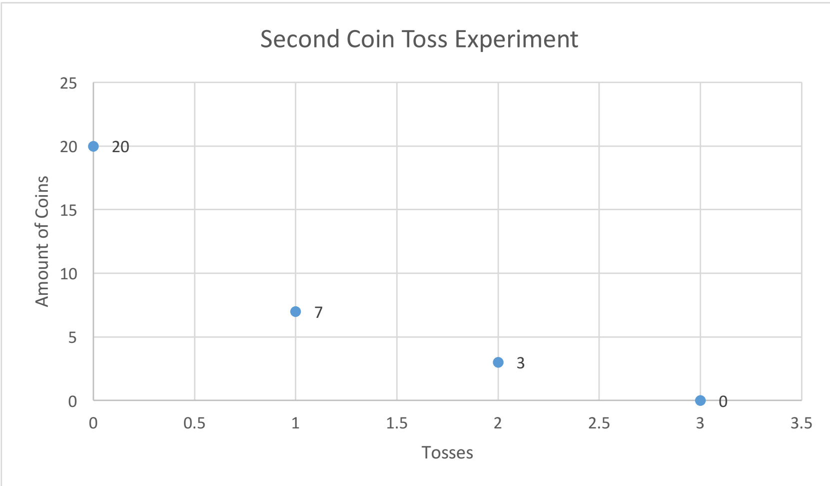
iii) The physical phenomenon that this models is the amount of tosses that would statistically take until there are no tail coins left and how many coins one may have left over after each toss. Exponential decay

c)

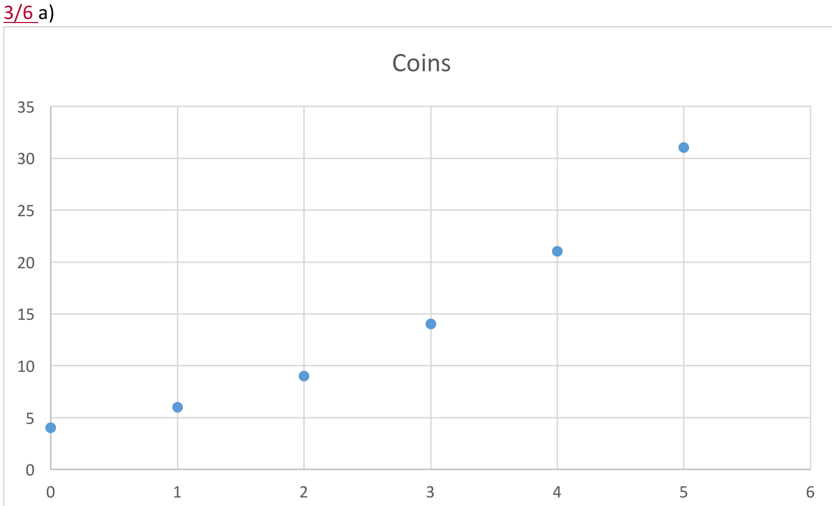
$$y = N_0(0.5)^x$$

d)

Toss	Coins
0	20
1	7
2	3
3	0



23. 3/6 a)



b) The graph appears exponential because the amount of coins that are being counted are working off of the previous amount. This is causing the graph to grow exponentially because every number is growing at a rate in which every preceding number has grown.

c)

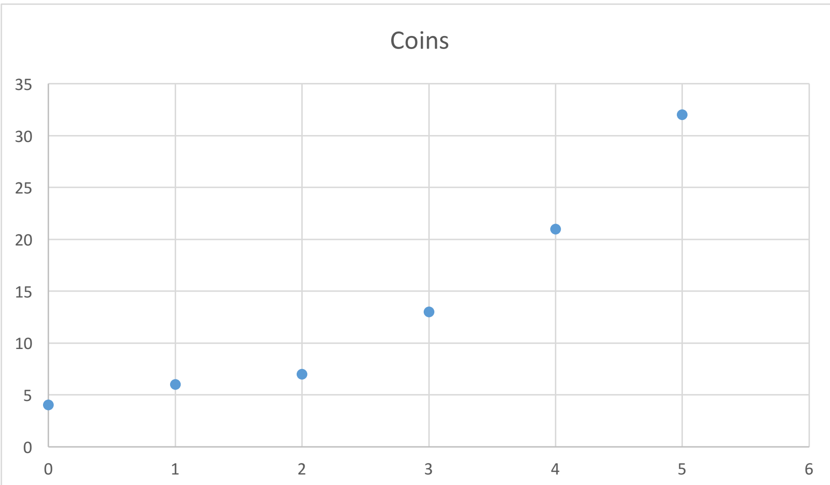
$$y = 4\left(\text{base should be}\,\frac{3}{2}\,2\right)^{0.6x} \quad \text{exponent should be n}$$

d)

$y = N_0(2)^x$ same as above

e)

Toss	Number of Heads	Coins
0		4
1	2	6
2	1	7
3	6	13
4	8	21
5	11	32



f)

$A = P(1+i)^{n+1}$ base is 1.25, exponent is just 1

24. 2/5 a)

$$4x - 3 = 7$$
$$4x = 10$$

$x = \frac{10}{4} = 2.5$ good

b)

$15x^2 + x - 6 = 0$ factor instead of using the quadratic theorem

$$x = \frac{-1 \pm \sqrt{1^2 - 4(15)(-6)}}{2(15)} = \frac{-1 \pm \sqrt{1+360}}{30} = \frac{-1 \pm \sqrt{361}}{30} = \frac{-1 - \sqrt{361}}{30}, \frac{\sqrt{361} - 1}{30}$$

c)

$$3x^2 - 8x - 1 = 0$$

$x = \frac{-8 \pm \sqrt{8^2 - 4(3)(1)}}{2(3)} = \frac{-8 \pm \sqrt{64-12}}{6} = \frac{-8 \pm \sqrt{52}}{6} = \frac{-8 \pm 2\sqrt{13}}{6} = \frac{-4 \pm \sqrt{13}}{3} = \frac{-4 - \sqrt{13}}{3}, \frac{-4 + \sqrt{13}}{3}$ root should be 19

25. 3/3 a)

$$3^{4x-5} = \frac{1}{27} = \frac{1}{3^3} = 3^{-3}$$
$$4x - 5 = -3$$
$$4x = 2$$
$$x = 0.5$$

b)

$$4^{x-2} = 8^{x+1}$$
$$2^{2(x-2)} = 2^{3(x+1)}$$
$$2x - 4 = 3x + 3$$
$$3x - 2x = -3 - 4$$
$$x = -7$$

26. 5/5 a)

$$2^{x+3} - 2^x = 224$$
$$2^x(2^3 - 1) = 2^5 7$$
$$2^x(7) = 2^5 7$$
$$2^x = 2^5$$
$$x = 5$$

b)

$$4(2^{2x}) + 31(2^x) - 8 = 0$$
$$2^x = \frac{-31 \pm \sqrt{31^2 - 4(4)(-8)}}{2(4)} = \frac{-31 \pm \sqrt{961 + 128}}{8} = \frac{-31 \pm \sqrt{1089}}{8} = \frac{-31 \pm 33}{8} = -8, 0.25$$
$$2^x = -8, 0.25$$
$$x = \log_2 -8\,, \textit{does not exist}$$
$$x = \log_2 0.25 = -2$$

27. 2/2

$$2^{x+3y} = 128$$
$$\log_2 128 = x + 3y$$
$$7 = x + 3y$$

$$2^{3x-y} = 2$$
$$\log_2 2 = 3x - y$$
$$1 = 3x - y$$

$$(3x + 9y = 21) - (3x - y = 1) = (10y = 20)$$
$$y = 2$$
$$3x - 2 = 1$$
$$3x = 3$$
$$x = 1$$

28. 1/4

$$3^x = 7^2$$
$$\log_3 7^2 = x$$

$x = 2\log_3 7$ what does this equal? You need to solve for the value of x using interpolations

29. 4/5 a)

$$\log_3(2x+3)-\log_3(x-2)=2$$
$$\log_3\left(\frac{2x+3}{x-2}\right)=2$$
$$3^2=9=\frac{2x+3}{x-2}$$
$$9(x-2)=2x+3$$
$$9x-18=2x+3$$
$$7x=21$$
$$x=3$$

b)

$\log_9(x-6)+\log_9(x+2)=1$this converts to multiplication not division

$$\log_9\left(\frac{x-6}{x+2}\right)=1$$
$$9^1=\frac{x-6}{x+2}$$
$$9(x+2)=x-6$$
$$9x+18=x-6$$
$$8x=-24$$
$$x=-3$$

30. 3/3

$$80\ kg=(200\ kg)(1-0.03)^x$$
$$0.4=0.97^x$$

$x=\log_{0.97}0.4\cong 30$ good

Unit One Mark: 95/ 112 = 85%

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