MHF4U1-ASSIGNMENT CHAPTER 7 **NAME:**___________________________

K: **/31** **I:** **/19** **C:** **/16** **A:** **/18**

Multiple Choice [K: 31 marks]

Identify the choice that best completes the statement or answers the question.

c 1 Express $\sqrt[4]{1024}$ as a power with a base of 2.

a. 2^{10}

b. $2^{\frac{2}{5}}$

c. $2^{\frac{5}{2}}$

d. $2^{\frac{3}{4}}$

$\sqrt[4]{1024} = \sqrt[4]{2^{10}} = 2^{\frac{10}{4}} = 2^{\frac{5}{2}}$

d 2 Express 17^4 as a power with a base of 2.

a. $\log_2 17^4$

b. $2^{\frac{\log 2}{\log 17}}$

c. $\log_2 17 \times \log_2 4$

d. $2^{\frac{4\log 17}{\log 2}}$

$2^x = 17^4$

$\log 2^x = \log 17^4$

$x \log 2 = 4 \log 17$

$x = \frac{4\log 17}{\log 2}$

So $2^{\frac{4\log 17}{\log 2}} = 17^4$

b 3 Express $\frac{2^6 \times \left(\frac{1}{4}\right)^5}{\left(\sqrt[4]{16}\right)^3}$ as a power with a base of 4.

a. 4^{-2}

b. $4^{-\frac{7}{2}}$

c. $4^{-\frac{3}{2}}$

d. $4^{\frac{1}{2}}$

$\frac{2^6 \cdot \left(\frac{1}{4}\right)^5}{(\sqrt[4]{16})^3} = \frac{(2^2)^3 \cdot (4^{-1})^5}{(\sqrt[4]{4^2})^3}$

$= \frac{(4)^3 \times (4)^{-5}}{((4^2)^{\frac{1}{4}})^3}$

$= \frac{(4)^{-2}}{4^{\frac{3}{2}}}$

$= 4^{-2-\frac{3}{2}} = 4^{-\frac{7}{2}}$

c 4 Solve the equation $4^{x-3} = 32^{2x+1}$. $\longrightarrow (2^2)^{x-3} = (2^5)^{2x+1} \longrightarrow 2^{2x-6} = 2^{10x+5}$

a. $x = -1$

b. $x = -\frac{1}{2}$

c. $x = -\frac{11}{8}$

d. $x = -2$

$2x - 6 = 10x + 5$

$-5 - 6 = 10x - 2x$

$-11 = 8x$

$x = -\frac{11}{8}$

b 5 Solve the equation $2 \times 16^x = 4 \times 8^{3x+2}$. $\longrightarrow 2(2^4)^x = 2^2(2^3)^{3x+2}$

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

b. $x = -\frac{7}{5}$

c. $x = 2$

d. $x = -\frac{9}{5}$

$2(2^{4x}) = 2^2(2^{9x+6})$

$2^{4x+1} = 2^{9x+6+2}$

$4x+1 = 9x+8 \longrightarrow -8+1 = 9x - 4x$

$-7 = 5x$

$x = -\frac{7}{5}$

* C 6 Solve the equation $4 = 2.13^x$. use calculator

$X = \frac{\log 4}{\log 2.13} = 1.83$

a. $x \doteq 1.87$ c. $x \doteq 1.83$

b. $x \doteq 0.54$ d. $x \doteq 0.96$

$4x+1 = 9x+8 \rightarrow -8+1 = 9x-4x$
$-7 = 5x$
$x = -\frac{7}{5}$

b. $x \doteq 0.54$ d. $x \doteq 0.96$

* C 7 Solve the equation $3 = 20\left(\frac{1}{2}\right)^{2x}$. $\log 3 = \log\left(20 \times \left(\frac{1}{2}\right)^{2x}\right) \rightarrow \log 3 = \log 20 + \log\left(\frac{1}{2}\right)^{2x}$

a. $x \doteq 5.47$ c. $x \doteq 1.37$

b. $x \doteq -0.52$ d. $x \doteq 2.31$

$\log 3 = \log 20 + 2x\log\left(\frac{1}{2}\right)$

$\log 3 - \log 20 = 2x\log\left(\frac{1}{2}\right)$

$X = \frac{\log 3 - \log 20}{2\log\left(\frac{1}{2}\right)}$ or $\frac{\log 3 - \log 20}{-2\log(2)}$

b. $x \doteq -0.52$ d. $x = $

* d 8 Solve the equation $24 = 6(3)^{3x+2}$.

a. $x \doteq 1.62$ c. $x \doteq -0.71$

b. $x \doteq 1.08$ d. $x \doteq -0.25$

$4 = 3^{3x+2}$

$\log 4 = \log 3^{3x+2}$

$\log 4 = (3x+2)\log 3 \longrightarrow \log 4 = 3x\log 3 + 2\log 3$

C 9 Evaluate, using the laws of logarithms.

$\log_4 512 + \log_4 8 = \log_4(2^9) + \log(2^3)$

$= \log_4(2^9 \times 2^3)$

$= \log_4(2^{12}) = \log_4(4^6) \longrightarrow 6\log_4 4 = 6$

a. 2 c. 6

b. 4 d. 8

a 10 Evaluate, using the laws of logarithms.

$\log_4 128 - \log_4 32$

a. 1

b. 2

$= \log_4(2^7) - \log_4(2^5)$

$= \log_4\left(\frac{2^7}{2^5}\right)$

$= \log_4(2^2)$

$= \log_4 4 = 1$

b 11 Evaluate, using the laws of logarithms.

$\log_8 768 + \log_8 16 - \log_8 3$

$= \log_8\left(\frac{768 \times 16}{3}\right) = \log_8(256 \times 16)$

$= \log_8(2^8 \times 2^4)$

$= \log_8(2^{12}) = \log_8(2^3)^4$

$= \log_8(8)^4 = 4$

a. 2 c. 6

b. 4 d. 8

6
8

C 12 Evaluate, using the laws of logarithms.

$\log_8 256 + \log_8 4 - \log_8 7 + \log_8 224$

$= \log_8\left(\frac{256 \times 4 \times 224}{7}\right)$

$= \log_8(256 \times 4 \times 32)$

$= \log_8(2^8 \times 2^2 \times 2^5)$

$= \log_8(2^{15}) = \log_8(2^3)^5 = \log_8(8)^5 = 5$

a. 3 c. 5

b. 4 d. 6

a 13 Write as a single logarithm.

$\log x^4 + \frac{1}{2}\log x^4$

$= \log x^4 + \log (x^4)^{\frac{1}{2}} = \log x^4 + \log x^2 = \log (x^4 \times x^2) = \log x^6$

a. $\log x^6$
b. $\log x^8$
c. $\log x^4\sqrt{x}$
d. $\frac{1}{2}\log x^8$

d 14 Write as a single logarithm.

$\log\sqrt{x} - \log x^2 + \frac{3}{4}\log x^4$

a. $\log x$
b. $2\log x$
c. $\frac{1}{2}\log x$
d. $\frac{3}{2}\log x$

$= \log x^{\frac{1}{2}} - \log x^2 + \log (x^4)^{\frac{3}{4}} =$
$\log x^{\frac{1}{2}} - \log x^2 + \log x^3$
$= \log \left(\frac{x^{\frac{1}{2}} \cdot x^3}{x^2}\right) = \log x^{\frac{1}{2}+3-2}$
$= \log x^{\frac{3}{2}}$
$= \frac{3}{2}\log x$

d 15 The restrictions on the variable in the expression $\log(x^2 - 9) - \log(x^2 + 6x + 9)$ is

a. $x > 3$
b. $x < 3$
c. $x < -3$
d. A and C

$x^2 - 9 > 0$
$x^2 > 9$
$x > 3, x < -3$

$x^2 + 6x + 9 > 0$
$(x+3)(x+3) > 0$
$(x+3)^2 > 0$
Always

d 16 The restriction on the variable in the expression $\log(2x^2 - 5x - 3) - \log(x^2 - 7x + 12)$ is

a. $x > 4$
b. $x > 3$
c. $x < -\frac{1}{2}$
d. A and C

$2x^2 - 5x - 3 > 0$
$(2x+1)(x-3) > 0$

Scenario 1 Both +'ve
$2x+1 > 0$ $x-3 > 0$
$x > -\frac{1}{2}$ $x > 3$
$x > 3$

Scenario 2 both -'ve
$2x+1 < 0$ $x-3 < 0$
$x < -\frac{1}{2}$ $x < 3$
$x < -\frac{1}{2}$ *

$x^2 - 7x + 12 > 0$
$(x-4)(x-3) > 0$

Scenario 1 both +'ve
$x-4 > 0$ $x-3 > 0$
$x > 4$ $x > 3$
$x > 4$ *

Scenario 2 both -'ve
$x-4 < 0$ $x-3 < 0$
$x < 4$ $x < 3$
$x < 3$

b 17 Solve the equation $\log_4 x = \log_4 15 - \log_4 3$.

a. $x = 1.16$
b. $x = 5$
c. $x = 0.107$
d. $x = 4$

$\log_4 x = \log_4\left(\frac{15}{3}\right)$

Same base so..

$x = \frac{15}{3} = 5$

d 18 Solve the equation $2\log_4 64 = 3\log_4 x$.

Same base

a. $x = 4$
b. $x = 3$
c. $x = 1$
d. $x = 16$

$64^2 = x^3$

$x = \sqrt[3]{64^2} = (64^{\frac{1}{3}})^2 = (4)^2 = 16$

b 19 Solve the equation $\dfrac{\log_6 46\,656}{\log_2 8} = \log_x 256$.

a. $x = 2$
b. $x = 16$
c. $x = 12$
d. $x = 8$

$\log_x 256 = \dfrac{\log_6 (6^6)}{\log_2 (2^3)} = \dfrac{6\log_6 6}{3\log_2 2}$

$\log_x 256 = 2$

so $x^2 = 256$

$x = \pm 16$

a 20 Solve the equation $\frac{\log_4 x}{\log_9 729} = 2\log_4 \sqrt{16}$.

a. $x = 4096$
b. $x = 2048$
c. $x = 16$
d. $x = 6$

b. $x = 2048$

$\frac{\log_4 x}{\log_9 9^3} = 2\log_4 \sqrt{4^2}$

$\frac{\log_4 x}{3 \log_9 9} = 2\log_4 4$ so $\log_4 x = 6$

$x = 4^6 = 4096$

a 21 Solve the equation $\log_3(2x+1) = 4$.

a. $x = 40$
b. $x = \frac{11}{2}$
c. $x = 20$
d. $x = 7$

$3^4 = 2x+1$

$81 - 1 = 2x$

$x = \frac{80}{2} = 40$

d 22 Solve the equation $4 - \log_2(2-3x) = -1$.

a. $x = 4$
b. $x = -2$
c. $x = 2$
d. $x = -10$

$4+1 = \log_2(2-3x)$

$2^5 = 2-3x$

$32 - 2 = -3x$

$30 = -3x$

$x = -10$

a 23 Solve the equation $\log(x-3)^2 = 2$. * $x-3>0$ so $x>3$ *

a. $x = 13$
b. $x = -7$
c. $x = 3$
d. A and B

$2\log(x-3) = 2$

$\log(x-3) = 1$

$10^1 = x-3$

$x = 13$

Method 2

$\sqrt{(x-3)^2} = \sqrt{10^2}$

$x - 3 = \pm 10$

Case 1

$10 = x-3$

$x = 13$

~~Case 2~~

$\cancel{-10 = x-3}$

$\cancel{x = -7}$

c 24 Solve the equation $\log_2(4-x)^2 = 4$. * $4-x>0$ so $x<4$ *

a. $x = -8$
b. $x = 8$
c. $x = 0$
d. B and C

b. $x = 8$

$2^4 = (4-x)^2$

$\sqrt{16} = \sqrt{(4-x)^2}$

$\pm 4 = 4 - x$

Case 1 (+4)

$+4 = 4 - x$

$0 = -x$

$x = 0$

~~Case 2 (-4)~~

$\cancel{-4 = 4-x}$

$\cancel{-8 = -x}$

$\cancel{x = 8}$

can't be Case 2 because $x<4$

c 25 Solve the equation $\log_2 \sqrt{5x+1} = 4$.

a. $x = 3$
b. $x = \frac{5}{3}$
c. $x = 51$
d. $x = 1$

$\frac{1}{2}\log_2(5x+1) = 4$

$\log_2(5x+1) = 8$

$2^8 = 5x+1$

$256 = 5x+1$

$255 = 5x$

$x = 51$

* $(x^2+24x)>0 \longrightarrow x(x+24)>0$ so ~~$x>0$~~ (redundant) and $x>-24$

b 26 Solve the equation $\log_4 \sqrt{x^2+24x} = 2$.

a. $x = -32$
b. $x = 8$
c. A and B
d. $x = 4$

$\frac{1}{2}\log_4(x^2+24x) = 2$

$\log_4(x^2+24x) = 4$

$4^4 = x^2 + 24x$

$0 = x^2 + 24x - 256$

$0 = (x+32)(x-8)$

$x = -32 \quad x = 8$ But $x>-24$

a 27 Solve the equation $\log_2 x + \log_2(x+1) = \log_2 6$. * ~~$x>0$~~ (redundant) $x>-1$

a. $x = 2$
b. $x = -3$
c. neither A nor B
d. A and B

$\log_2(x(x+1)) = \log_2 6$

$x^2 + x = 6$

$x^2 + x - 6 = 0$

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

$x = -3 \quad x = 2$ But $x>-1$

d. 28 Solve the equation $\log_6\left(x^2 + 19x + 124\right) = 3$.

* $x^2+19x+124>0$ no real roots. ie) won't be negative.

a. $x = 4$
b. $x = -23$
c. neither A nor B
d. A and B

$6^3 = x^2+19x+124$
$0 = x^2+19x+124-216$
$0 = x^2+19x-92$
$0 = (x+23)(x-4)$
$x=-23 \quad x=4$

b 29 Solve the equation $\log(x + 6) - \log(2x + 1) = \log 4$.

a. $x = 1$
b. $x = \frac{2}{7}$
c. $x = \frac{5}{7}$
d. $x = \frac{9}{2}$

* $x+6>0$ ~~$x>-6$~~ redundant
$2x+1>0$
$x>-\frac{1}{2}$

b 30 Solve the equation $\log\left(3x^2 - 12\right) - \log(x + 2) = \log 6$.

a. $x = 0$
b. $x = 4$
c. $x = 6$
d. $x = 1$

* $3x^2-12>0$
$x^2>4$
$x<-2, \ x>2$
$x+2>0$
$x>-2$

$\log\left(\frac{3x^2-12}{x+2}\right) = \log 6 \Rightarrow \frac{3x^2-12}{x+2} = 6$
$3x^2-12 = 6x+12$
$x^2-4 = 2x+4$
$0 = x^2-2x-8$
$= (x-4)(x+2)$
$x=4, \cancel{-2}$

b 31 Solve the equation $\log_3\left(\log_2 x\right) = 1$.

* $x>0$

a. $x = 2$
b. $x = 8$
c. $x = 4$
d. $x = 1$

$3^1 = \log_2 x$ so $2^3 = x$

32)

$$\left(\sqrt{256}\right)^{2x+3} = \left(\frac{1}{64}\right)^{x-5}$$

$$\left(\sqrt{2^8}\right)^{2x+3} = \left((64)^{-1}\right)^{x-5}$$

$$\left(2^{\frac{8}{2}}\right)^{2x+3} = \left(\left(2^6\right)^{-1}\right)^{x-5}$$

$$\left(2^4\right)^{2x+3} = \left(2^{-6}\right)^{x-5}$$

$$2^{8x+12} = 2^{-6x+30}$$

$$8x+12 = -6x+30$$

$$8x+6x = 30-12$$

$$2x = 18$$

$$x = 9$$

33)

$$6^{3x+1} = 2^{2x-3}$$

$$\log 6^{3x+1} = \log 2^{2x-3}$$

$$(3x+1)(\log 6) = (2x-3)\log 2$$

$$3x\log 6 + \log 6 = 2x\log 2 - 3\log 2$$

$$3x\log 6 - 2x\log 2 = -3\log 2 - \log 6$$

$$x\left(3\log 6 - 2\log 2\right) = -3\log 2 - \log 6$$

$$x = \frac{-3\log 2 - \log 6}{3\log 6 - 2\log 2}$$

34)

$$\log_{18} 9 + \log_{18} 864 - \log_{18} 4 + \log_{18} 3$$

$$= \log_{18}\left(\frac{9 \times \overset{216}{\cancel{864}} \times 3}{\cancel{4}}\right) = \log_{18}\left(3^2 \times (216) \times 3\right)$$

$$= \log_{18}\left(3^2 \times 3^3 \times 8 \times 3\right)$$

$$= \log_{18}\left(3^6 \times 2^3\right)$$

$$= \log_{18}\left(\left(3^2\right)^3 \times 2^3\right)$$

$$= \log_{18}\left(9^3 \times 2^3\right)$$

$$= \log_{18}\left(18^3\right)$$

$$= \log_{18}(18)^3$$

$$= 3\log_{18}(18)$$

$$= 3$$

36) $\log\left(\frac{a^3\sqrt{ab}}{(ab)^2}\right) =$

Method 1: simplify in bracket

$\log\left(\frac{a^3\sqrt{ab}}{a^2 b^2}\right)$

$= \log\left(\frac{a\sqrt{a}\sqrt{b}}{b^2}\right)$

$= \log\left(a^{3/2} b^{-3/2}\right)$

$= \log a^{3/2} + \log b^{-3/2}$

$= \frac{3}{2}\log a - \frac{3}{2}\log b = \frac{3}{2}(\log a - \log b)$

Method 2: use product & quotient law

$\log\left(\frac{a^3\sqrt{ab}}{a^2 b^2}\right)$

$= \log a^3 + \log\sqrt{a} + \log\sqrt{b} - \log a^2 - \log b^2$

$= 3\log a + \frac{1}{2}\log a + \frac{1}{2}\log b - 2\log a - 2\log b$

$= \log a\left(3 + \frac{1}{2} - 2\right) + \log b\left(\frac{1}{2} - 2\right)$

$= \frac{3}{2}\log a - \frac{3}{2}\log b$

$= \frac{3}{2}(\log a - \log b)$

37) $\log_5\left[\log_4(\log_2 x)\right] = 1$

$5^1 = \log_4(\log_2 x)$

$4^5 = \log_2 x$

$2^{4^5} = x$

$x = 2^{1024}$ = some really big-ass numbah

38) $\log_{-2}\left(-\frac{1}{8}\right) = -3$

Could be initially (and perhaps instinctively) written as

$-2^{-3} = -\frac{1}{8}$ and although it makes sense algebraically

it's not a valid logarithmic equation because

$\log_a b = \frac{\log b}{\log a}$ and in this case we'd get

$\frac{\log\left(-\frac{1}{8}\right)}{\log(-2)}$ which is impossible because 10 raised to any exponent cannot equate a negative number.

38) $200g = A_0$ $t = 3h$ $A(3) = 140g$

a)

$$A(t) = A_0\left(\tfrac{1}{2}\right)^{\frac{t}{h}}$$

$$140 = 200\left(\tfrac{1}{2}\right)^{\frac{3}{h}}$$

$$\frac{140}{200} = \left(\tfrac{1}{2}\right)^{\frac{3}{h}}$$

$$\log\left(\tfrac{140}{200}\right) = \log\left(\tfrac{1}{2}\right)^{3/h}$$

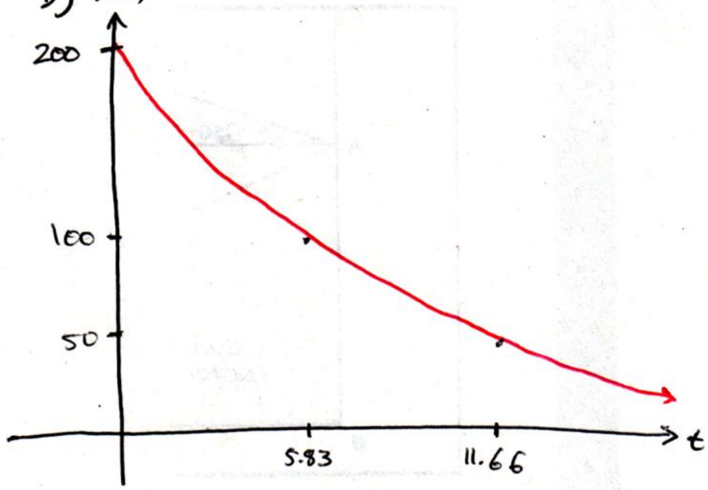
$$\log\left(\tfrac{140}{200}\right) = \frac{3}{h}\log\left(\tfrac{1}{2}\right)$$

$$h = \frac{3\log\left(\frac{1}{2}\right)}{\log\left(\frac{140}{200}\right)}$$

$$h = 5.83$$

$\therefore$ the half-life of this substance is 5.83 hrs.

b)



39) $A_0 = 20\text{ mg}$ $h = 3.1\text{ min} \times 60\text{ s/min} = 186\text{ s}$ $A(t) = 0.815A_0$ $t = ?$ seconds

$$0.815A_0 = A_0\left(\tfrac{1}{2}\right)^{t/186}$$

$$0.815(20) = 20\left(\tfrac{1}{2}\right)^{t/186}$$

$$16.3 = 20\left(\tfrac{1}{2}\right)^{t/186}$$

$$\frac{16.3}{20} = \left(\tfrac{1}{2}\right)^{t/186}$$

$$\log\left(\tfrac{16.3}{20}\right) = \log\left(\tfrac{1}{2}\right)^{t/186}$$

$$\log\left(\tfrac{16.3}{20}\right) = \frac{t}{186}\log\left(\tfrac{1}{2}\right)$$

$$t = \frac{186\left(\log\left(\frac{16.3}{20}\right)\right)}{\log\left(\frac{1}{2}\right)}$$

$$t = 54.89 \text{ seconds}$$

$\therefore$ It would take 54.89 seconds for polonium to reach 81.5% its initial mass.

40) $h = 29$ years $\quad A(t) = ?$ after $t = 18$ years if $A_0 = 100g$.

$$A(t) = A_0 \left(\tfrac{1}{2}\right)^{\frac{t}{h}}$$

$$= 100\left(\tfrac{1}{2}\right)^{\frac{18}{29}}$$ * Use your calculator

$$= 100(0.65036)$$

$$= 65.036$$

∴ The remaining mass of strontium after 18 years is 65.04g, approximately.

41) 20% depreciation per year means it's $0.8 \times$ original value.

$A(t) = 0.5A_0$ is what we want to find.

We want to find t...

so... knowing...

$$A(t) = A_0(0.8)^t$$

we have: $0.5A_0 = A_0(0.8)^t$

$$0.5 = (0.8)^t$$

$$\log(0.5) = \log(0.8)^t$$

$$\log(0.5) = t\log(0.8)$$

$$t = \frac{\log(0.5)}{\log(0.8)} = 3.106$$

∴ The time it takes for the car to depreciate to half its original value is 3.106 years, approximately.

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41. A car depreciates at a rate of 20% per year. How long will it take for the car to reach half its original value? [A: 4 marks]

Application Multiple Choice **[A: 3 marks]**

_b_ 42. A 25-g sample of a substance decays to 13 g in 14 years. The half-life of this substance is approximately

a. 3.77 years
b. 14.8 years
c. 8.59 years
d. 14.1 years

Use $A(t) = A_0\left(\frac{1}{2}\right)^{\frac{t}{h}}$

$13 = 25\left(\frac{1}{2}\right)^{14/h}$

$\frac{13}{25} = \left(\frac{1}{2}\right)^{14/h} \rightarrow \log\frac{13}{25} = \log\left(\frac{1}{2}\right)^{14/h}$

$\rightarrow \log\frac{13}{25} = \frac{14}{h}\log\left(\frac{1}{2}\right) \rightarrow h = \frac{14\log\left(\frac{1}{2}\right)}{\log\left(\frac{13}{25}\right)}$

_c_ 43. The half-life of a radioactive substance is 97 years. If 10 mg are produced after a reaction, approximately how long will it take for only 1 mg to remain?

a. 29 years
b. 180 years
c. 322 years
d. 462 years

$h = 97$ years

$A_0 = 10\,mg \quad A(t) = 1\,mg$

$1 = 10\left(\frac{1}{2}\right)^{t/97}$

$\frac{1}{10} = \left(\frac{1}{2}\right)^{t/97}$

$\log\left(\frac{1}{10}\right) = \log\left(\frac{1}{2}\right)^{t/97}$

$\log\left(\frac{1}{10}\right) = \frac{t}{97}\log\left(\frac{1}{2}\right)$

$t = \frac{97\log\left(\frac{1}{10}\right)}{\log\left(\frac{1}{2}\right)} = \frac{97\log(10)}{\log(2)}$

_d_ 44. The value, D, in dollars, of a certain vehicle as a function of time, t, in years, depreciates according to the function $D = 35\,000\left(\frac{1}{2}\right)^{\frac{t}{4}}$. How long will it take for this vehicle to be worth $20 000?

a. 0.80 years
b. 1.75 years
c. 4.26 years
d. 3.23 years

$20\,000 = 35000\left(\frac{1}{2}\right)^{\frac{t}{4}}$

$\frac{20\,000}{35\,000} = \left(\frac{1}{2}\right)^{\frac{t}{4}}$

$\log\left(\frac{20}{35}\right) = \log\left(\frac{1}{2}\right)^{t/4}$

$\log\left(\frac{4}{7}\right) = \frac{t}{4}\log\left(\frac{1}{2}\right)$

$t = \frac{4\log\left(\frac{4}{7}\right)}{\log\left(\frac{1}{2}\right)}$

45. Choose a question from #33-49 that you are confident in answering correctly. You will teach how to solve this question in front of the entire class. [C: 10 marks]

[2 marks for correct solution, 2 marks for clarity in voice, 2 marks for clarity in writing, 2 marks for extemporaneous quality, 2 marks for paying attention to other classmates' presentation]