LOGARITHMS PRACTICE

SIMPLIFYING EXPRESSIONS

Question 1

Simplify each of the following logarithmic expressions, giving the final answer as a single logarithm.

a) $\log_2 7+\log_2 2$

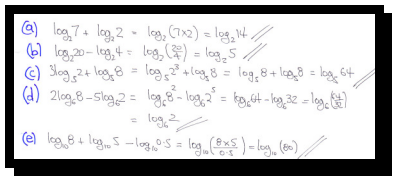
b) $\log_2 20-\log_2 4$

c) $3\log_5 2+\log_5 8$

d) $2\log_6 8-5\log_6 2$

e) $\log_{10} 8+\log_{10} 5-\log_{10} 0.5$

$\boxed{\log_2 14}$, $\boxed{\log_2 5}$, $\boxed{\log_5 64}$, $\boxed{\log_6 2}$, $\boxed{\log_{10} 80}$



Question 2

Simplify each of the following logarithmic expressions, giving the final answer as a single logarithm.

a) $\log_3 5+\log_3 2$

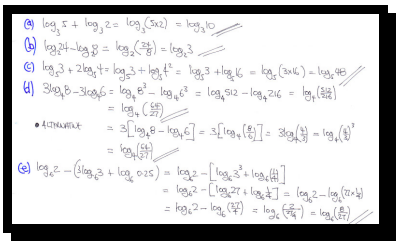
b) $\log_2 24-\log_2 8$

c) $\log_5 3+2\log_5 4$

d) $3\log_4 8-3\log_4 6$

e) $\log_6 2-\left(3\log_6 3+\log_6 0.25\right)$

$$\boxed{\log_2 10},\ \boxed{\log_2 3},\ \boxed{\log_5 48},\ \boxed{\log_4\left(\frac{64}{27}\right)},\ \boxed{\log_6\left(\frac{8}{27}\right)}$$



Question 3

Simplify each of the following logarithmic expressions, giving the final answer as a number not involving a logarithm.

a) $\log_2 4 - \log_2 0.5$

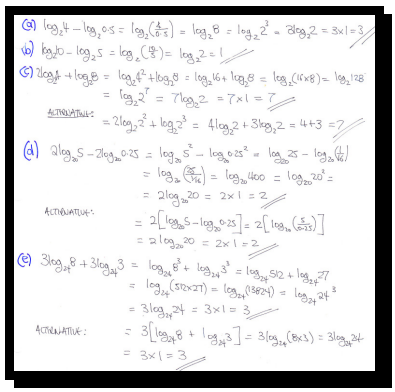
b) $\log_2 10 - \log_2 5$

c) $2\log_2 4 + \log_2 8$

d) $2\log_{20} 5 - 2\log_{20} 0.25$

e) $3\log_{24} 8 + 3\log_{24} 3$

$\boxed{3}, \boxed{1}, \boxed{7}, \boxed{2}, \boxed{3}$



Question 4

Simplify each of the following logarithmic expressions, giving the final answer as a number not involving a logarithm.

a) $\log_2 24 - \log_2 3$

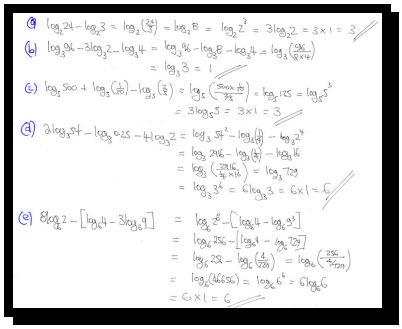
b) $\log_3 96 - 3\log_3 2 - \log_3 4$

c) $\log_5 500 + \log_5\left(\frac{1}{10}\right) - \log_5\left(\frac{2}{5}\right)$

d) $2\log_3 54 - \log_3 0.25 - 4\log_3 2$

e) $8\log_6 2 - \left(\log_6 4 - 3\log_6 9\right)$

$\boxed{3}, \boxed{1}, \boxed{3}, \boxed{6}, \boxed{6}$



Question 5

Simplify each of the following logarithmic expressions, giving the final answer as a number not involving a logarithm.

a) $2\log_{12} 3+4\log_{12} 2$

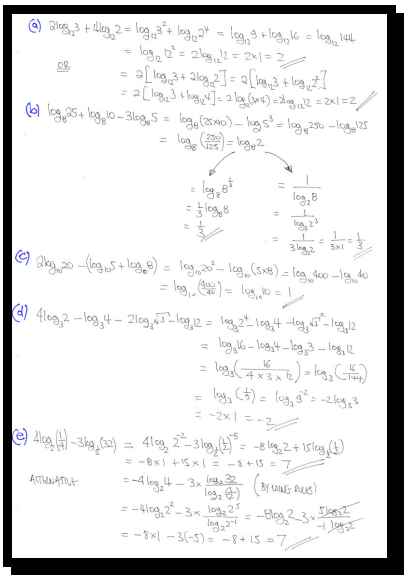
b) $\log_8 25+\log_8 10-3\log_8 5$

c) $2\log_{10} 20-\left(\log_{10} 5+\log_{10} 8\right)$

d) $4\log_3 2-\log_3 4-2\log_3 \sqrt{3}-\log_3 12$

e) $4\log_2\left(\frac{1}{4}\right)-3\log_{\frac{1}{2}}(32)$

$\boxed{2}$, $\boxed{\frac{1}{3}}$, $\boxed{1}$, $\boxed{-2}$, $\boxed{7}$



Question 6

Simplify each of the following logarithmic expressions, giving the final answer as a number not involving a logarithm.

a) $\log_2 40 - \log_2 5$

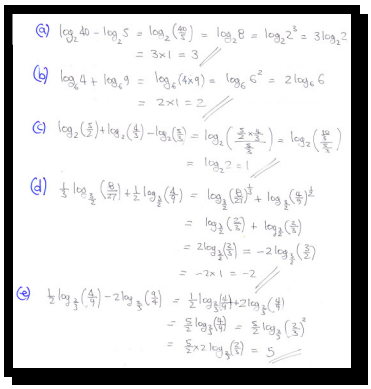
b) $\log_6 4 + \log_6 9$

c) $\log_2\left(\frac{5}{2}\right) + \log_2\left(\frac{4}{3}\right) - \log_2\left(\frac{5}{3}\right)$

d) $\frac{1}{3}\log_{\frac{3}{2}}\left(\frac{8}{27}\right) + \frac{1}{2}\log_{\frac{3}{2}}\left(\frac{4}{9}\right)$

e) $\frac{1}{2}\log_{\frac{2}{3}}\left(\frac{4}{9}\right) - 2\log_{\frac{2}{3}}\left(\frac{9}{4}\right)$

$\boxed{3}$, $\boxed{2}$, $\boxed{1}$, $\boxed{-2}$, $\boxed{5}$



Question 7

Simplify each of the following logarithmic expressions, giving the final answer as a single fraction.

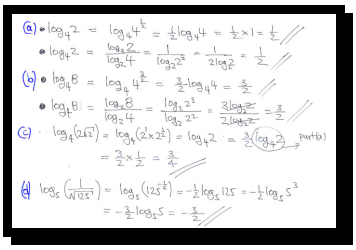
a) $\log_4 2$

b) $\log_4 8$

c) $\log_4\left(2\sqrt{2}\right)$

d) $\log_5\left(\dfrac{1}{\sqrt{125}}\right)$

$$\boxed{\frac{1}{2}}, \boxed{\frac{3}{2}}, \boxed{\frac{3}{4}}, \boxed{-\frac{3}{2}}$$



SOLVING EQUATIONS USING LOGARITHMS

Question 1

Solve each of the following exponential equations.

a) $3^x = 11$

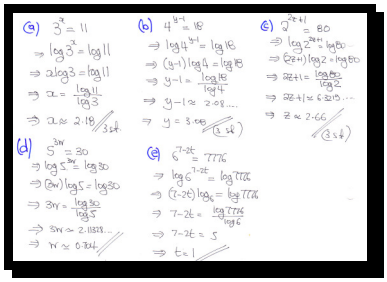
b) $4^{y-1} = 18$

c) $2^{2z+1} = 80$

d) $5^{3w} = 30$

e) $6^{7-2t} = 7776$

$\boxed{x \approx 2.18}$, $\boxed{y \approx 3.08}$, $\boxed{z \approx 2.66}$, $\boxed{w \approx 0.704}$, $\boxed{t = 1}$



Question 2

Solve each of the following exponential equations.

a) $4^{x} = 200$

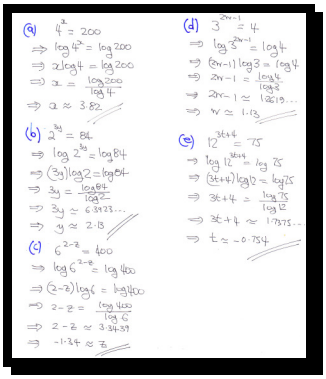
b) $2^{3y} = 84$

c) $6^{2-z} = 400$

d) $3^{2w-1} = 4$

e) $12^{3t+4} = 75$

$\boxed{x \approx 3.82}$, $\boxed{y \approx 2.13}$, $\boxed{z \approx -1.34}$, $\boxed{w \approx 1.13}$, $\boxed{t \approx -0.754}$



Question 3

Solve each of the following exponential equations.

a) $5\times 3^{x}=200$

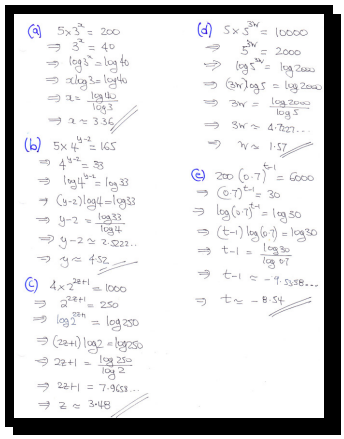
b) $5\times 4^{y-2}=165$

c) $4\times 2^{2z+1}=1000$

d) $5\times 5^{3w}=10000$

e) $200(0.7)^{t-1}=6000$

$\boxed{x\approx 3.36}$, $\boxed{y\approx 4.52}$, $\boxed{z\approx 3.48}$, $\boxed{w\approx 1.57}$ $\boxed{t\approx -8.54}$



Question 4

Solve each of the following exponential equations.

a) $3\times\left(\frac{1}{3}\right)^{x}=0.0042$

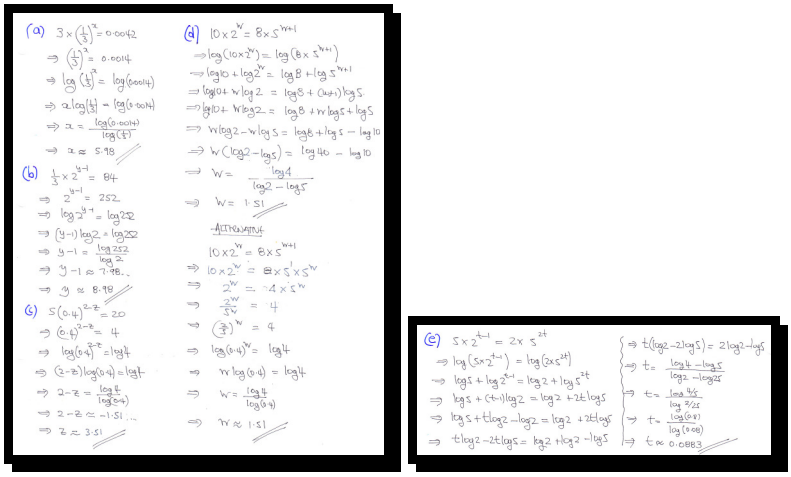
b) $\frac{1}{3}\times 2^{y-1}=84$

c) $5(0.4)^{2-z}=20$

d) $10\times 2^{w}=8\times 5^{w+1}$

e) $5\times 2^{t-1}=2\times 5^{2t}$

$\boxed{x\approx 5.98}$, $\boxed{y\approx 8.98}$, $\boxed{z\approx 3.51}$, $\boxed{w\approx -1.51}$, $\boxed{t\approx 0.0883}$



Question 5

Solve each of the following exponential equations.

a) $2^x = 3^{x+1}$

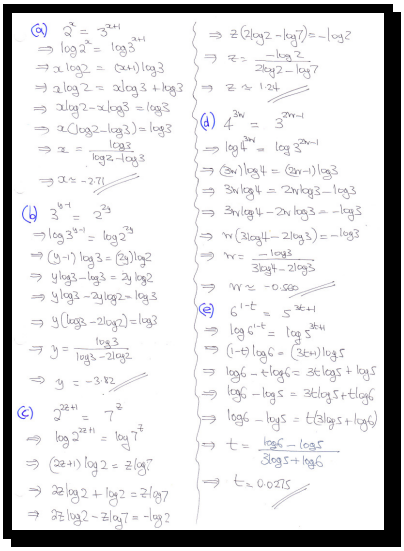
b) $3^{y-1} = 2^{2y}$

c) $2^{2z+1} = 7^z$

d) $4^{3w} = 3^{2w-1}$

e) $6^{1-t} = 5^{3t+1}$

$\boxed{x \approx -2.71}$, $\boxed{y \approx -3.82}$, $\boxed{z \approx 1.24}$, $\boxed{w \approx -0.560}$, $\boxed{t \approx 0.0275}$



Question 6

Solve each of the following exponential equations.

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

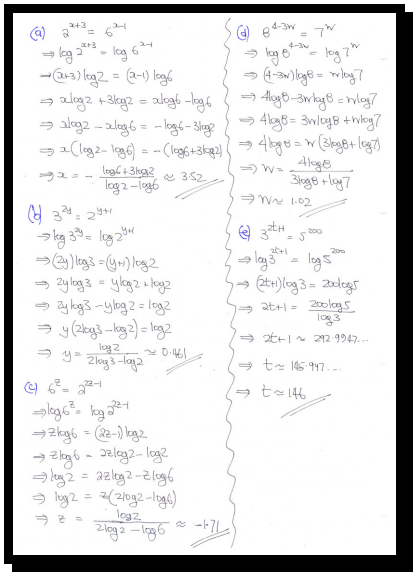
b) $3^{2y} = 2^{y+1}$

c) $6^{z} = 2^{2z-1}$

d) $8^{4-3w} = 7^{w}$

e) $3^{2t+1} = 5^{200}$

$\boxed{x \approx 3.52}$, $\boxed{y \approx 0.461}$, $\boxed{z \approx -1.71}$, $\boxed{w \approx 1.02}$, $\boxed{t \approx 146}$



Question 7

Solve each of the following equations giving your answer correct to 3 s.f.

a) $2^{2x}-2^{x}-6=0$

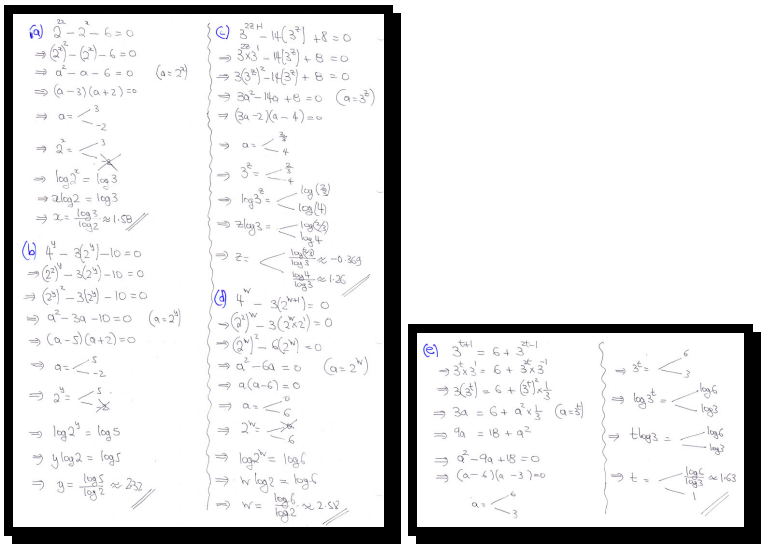
b) $4^{y}-3\left(2^{y}\right)-10=0$

c) $3^{2z+1}-14\times\left(3^{z}\right)+8=0$

d) $4^{w}-3\left(2^{w+1}\right)=0$

e) $3^{t+1}=6+3^{2t-1}$

$\boxed{x\approx 1.58}$, $\boxed{y\approx 2.32}$, $\boxed{z\approx 1.26 \text{ or } -0.369}$, $\boxed{w\approx 2.58}$, $\boxed{t=1 \text{ or } t\approx 1.63}$



Question 8

Solve each of the following equations giving your answer correct to 3 s.f.

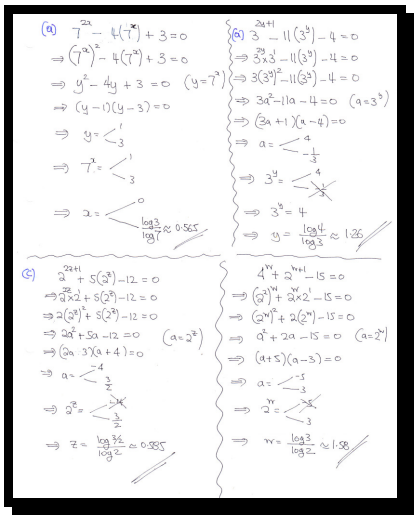
a) $7^{2x}-4\left(7^{x}\right)+3=0$

b) $3^{2y+1}-11\left(3^{y}\right)-4=0$

c) $2^{2z+1}+5\left(2^{z}\right)-12=0$

d) $4^{w}+2^{w+1}-15=0$

$\boxed{x\approx 0.565 \text{ or } x=0}$, $\boxed{y\approx 1.26}$, $\boxed{z\approx 0.585}$, $\boxed{w\approx 1.58}$



SOLVING EQUATIONS INVOLVING LOGARITHMS

Question 1

Solve each of the following logarithmic equations.

a) $\log_2(x+1)-\log_2 x=\log_2 3$

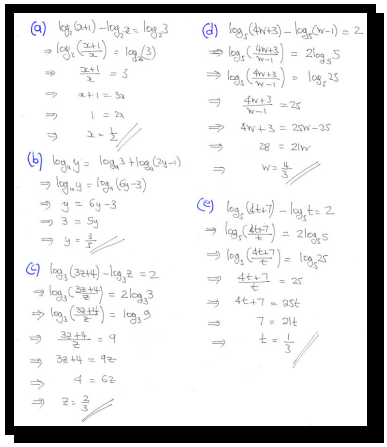
b) $\log_a y=\log_a 3+\log_a(2y-1)$

c) $\log_3(3z+4)-\log_3 z=2$

d) $\log_5(4w+3)-\log_5(w-1)=2$

e) $\log_5(4t+7)-\log_5 t=2$

$\boxed{x=\frac{1}{2}}$, $\boxed{y=\frac{3}{5}}$, $\boxed{z=\frac{2}{3}}$, $\boxed{w=\frac{4}{3}}$, $\boxed{t=\frac{1}{3}}$



Question 2

Solve each of the following logarithmic equations.

a) $\log_a(2x+7)=\log_a x+2\log_a 3$

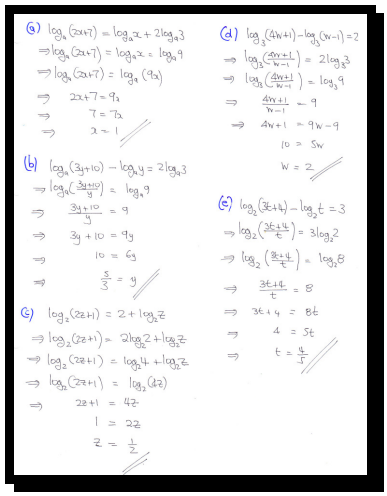
b) $\log_a(3y+10)-\log_a y=2\log_a 3$

c) $\log_2(2z+1)=2+\log_2 z$

d) $\log_3(4w+1)-\log_3(w-1)=2$

e) $\log_2(3t+4)-\log_2 t=3$

$\boxed{x=1}$, $\boxed{y=\frac{5}{3}}$, $\boxed{z=\frac{1}{2}}$, $\boxed{w=2}$, $\boxed{t=\frac{4}{5}}$



Question 3

Solve each of the following logarithmic equations.

a) $\log_5(125x)=4$

b) $\log_5 y-4\log_5 2=2$

c) $\log_2(4z+4)=6$

d) $\log_2(w^2+4w+3)=4+\log_2(w^2+w)$

e) $\log_3 8-3\log_3 t=3$

$\boxed{x=5}$, $\boxed{y=400}$, $\boxed{z=15}$, $\boxed{w=\frac{1}{5}, w\neq -1}$, $\boxed{t=\frac{2}{3}}$

