

Sample Question Sheet 2

No calculators allowed.

1) Logs. Recall that:

If $y = a^x$ then $x = \log_a y$ and the four rules of logarithms are:

- i) $\log(a) + \log(b) = \log(a \times b)$
- ii) $\log(a) - \log(b) = \log(a / b)$
- iii) $c \times \log(a) = \log(a^c)$
- iv) Change of Base: $\log_a(m) = \log_b(m) \times \log_a(b)$

Note that $\log_{10} x$ may also be written as $\lg(x)$ and $\log_e(x)$ is commonly written as $\ln(x)$.

a) Evaluate the following:

- i) $\log_{10} 100$ ii) $\log_2 (1/8)$ iii) $\log_{10} 0.01$ iv) $\log_2 (2\sqrt{2})$ v) $\log_p (p^5)$

b) If $A = \lg 2$ and $B = \lg 3$, write the following in terms of A and B.

- i) $\lg(54)$ ii) $\lg(72)$ iii) $\lg(\frac{9}{16})$ iv) $\lg(\frac{18}{27})$

- b) i) If $6^{x-1} = 3^{x+2}$ find n, m such that $x = \frac{\log_{10} n}{\log_{10} m}$. ii) Then change base so that x is in \log_2 .

2) Solve the following. (*Hint: Create a new expression for $y = ?$ then substitute it in.*)

a) $(3^{2x}) - 10(3^x) = -9$

3) Expand:

a) $(x + y)^3$

4) If ABCDEFGH is a regular octagon with sides of length 3, what is the area of triangle ADF?

5) Factorise the following:

- a) $x^3 - x$ b) $1 - 2y - 3y^2$ c) $x^4 - 2x^2 - 3$ d) $x^2y - 5xy + 4y$ e) $6x^2 - 11x - 7$

6) Simplify the following:

a) $\frac{x-3}{2x-6}$

b) $\frac{2x+3y}{4x^2-9y^2}$

c) $\frac{x^2+9x+20}{x+4}$

7) Solve the following inequalities and represent them on a number line: (use \circ for $<$ and \square for \leq)

a) $3x + 1 < 5x - 2$

b) $-(x + 1) \geq 8$

c) $3x - 7 \leq x + 4 < 2x + 1$

d) $x^2 > 4$

8) A mother is seven times as old as her daughter. Three years ago she was thirteen times as old. Find the ratio of their ages in 3 years time.

9) Find the equation of a line that has gradient 7 and passes through (5, 43).

10) Find the equation of a line that passes through (5, 8) and (8, 17).

11) Find the equation of a line parallel to $y = 2x + 5$ passing through (2, 3).

12) Find the equation of a line perpendicular to $y = 2x + 1$ passing through (-4, 8). Where do the lines cross? How far is (-4, 8) from the crossing place, and where would its mirror image be?

13) What is the mid-point, M, of A (1, 3) and B (5, 8)? If point P lies on the line AB and divides A and B such that AP:BP = 1:5 what are its coordinates? If you extend the line AB can you find another point P' which satisfies the same ratio?

