

## MODULUS FUNCTIONS

1. Solve the following equations for  $x$ .

a)  $|x - 2| = 5$                       b)  $|x + 5| = 5$                       c)  $|2x - 1| = 3$   
d)  $|3x + 4| = 5$                       e)  $|x + 1| = |x - 3|$                       f)  $|2x + 1| = |x + 5|$ .  
g)  $3|x - 1| = |x - 3|$                       h)  $|2x - 3| = |3x + 1|$ .

2. Solve the following inequalities for  $x$ .

a)  $|x - 2| \leq 4$                       b)  $|x - 2| < 4$                       c)  $|x - 2| > 4$   
d)  $|x - 1| \geq 3$                       e)  $|x - 5| \leq 3$                       f)  $|x - 5| > 2$   
g)  $|x - 3| \geq 4$                       h)  $|x + 1| \leq 3$ .

3. Solve the following equations for  $x$ .

i)  $|x| = |2x + 1|$                       ii)  $|x - 3| = |x + 10|$   
iii)  $|x| = |3x + 1|$                       iv)  $|x| = |4x + 1|$ ,  
v)  $|3x - 2| = |6 - 5x|$                       vi)  $|2x - 3| = |4 - 5x|$ ,  
vii)  $2|x - 3| = |x + 2|$                       viii)  $2|x - 3| = 3|x - 2|$ .

4. Find the greatest and least values of  $x$  satisfying:

a)  $|2x - 1| \leq 5$ ,                      b)  $|3x - 2| \leq 7$ .

5. Find the set of values of  $x$  satisfying:

a)  $|8^x - 17| < 15$ ,                      b)  $|9^x - 15| < 12$ .

6. Sketch the graph of  $y = 5 - x$ , **marking clearly any points of intersection with the axes.**

Sketch the graph of  $y = |5 - x|$ .

7. Sketch the graph of  $y = x - 2$ , marking clearly any points of intersection with the axes.

Sketch the graph of  $y = |x - 2|$ .

8. Sketch the graph of  $y = \sin x$  for  $x$  between  $0^\circ$  and  $360^\circ$ .

Sketch the graph of  $y = |\sin x|$  for  $x$  between  $0^\circ$  and  $360^\circ$ .

9. Sketch the following graphs on separate diagrams.

a)  $y = |2x - 3|$

b)  $y = |2x + 5|$

c)  $y = |\cos x|$ , for  $x$  between  $0^\circ$  and  $360^\circ$

d)  $y = |x(x - 2)|$

e)  $y = |x(x + 4)|$

f)  $y = |x^2 - 5x|$

g)  $y = |x^2 - 8x + 12|$

h)  $y = |x^2 - 3x - 10|$

i)  $y = |9 - x^2|$

j)  $y = |4x - x^2|$ .

\*10) Sketch the graph of  $|x + y| = 10$ .

**{Take care with this!}**

Answers.

1. a)  $x = -3$  or  $x = 7$ .      b)  $x = -10$  or  $x = 0$ .      c)  $x = -1$  or  $x = 2$ .  
d)  $x = -3$  or  $x = \frac{1}{3}$ .      e)  $x = 1$ .      f)  $x = -2$  or  $x = 4$ .  
g)  $x = 0$  or  $x = 1.5$ .      h)  $x = -4$  or  $x = \frac{2}{5}$ .
2. a)  $-2 \leq x \leq 6$ .      b)  $-2 < x < 6$ .      c)  $x < -2$  or  $x > 6$ .  
d)  $x \leq -2$  or  $x \geq 4$ .      e)  $2 \leq x \leq 8$ .      f)  $x < 3$  or  $x > 7$ .  
g)  $x \leq -1$  or  $x \geq 7$ .      h)  $-4 \leq x \leq 2$ .
3. i)  $x = -1$  or  $x = -\frac{1}{3}$       ii)  $x = -3.5$   
iii)  $x = -\frac{1}{4}$  or  $x = -\frac{1}{2}$       iv)  $x = -\frac{1}{5}$  or  $x = -\frac{1}{3}$   
v)  $x = 1$  or  $x = 2$       vi)  $x = 1$  or  $x = \frac{1}{3}$   
vii)  $x = \frac{4}{3}$  or  $x = 8$       viii)  $x = 0$  or  $x = \frac{12}{5}$ .
4. a)  $\{-2 \leq x \leq 3\}$     Least =  $-2$ , greatest =  $3$ .  
b)  $\left\{-\frac{5}{3} \leq x \leq 3\right\}$     Least =  $-\frac{5}{3}$ , greatest =  $3$ .
5. a)  $\frac{1}{3} < x < \frac{5}{3}$       b)  $\frac{1}{2} < x < \frac{3}{2}$ .