

USUAL EQUATIONS - worksheet

1. Solve.

a) $3x - 5 = 2(x + 3)$

$$3x - 5 = 2x + 6$$

$$3x - 2x = 5 + 6$$

$$\boxed{x = 11}$$

b) $4x + 1 = \frac{2}{7}(x - 14)$

$$4x + 1 = \frac{2}{7}x - 4$$

$$28x + 7 = 2x - 28$$

$$26x = -35$$

$$\boxed{x = -\frac{35}{26}}$$

c) $\frac{3}{5}x + 2 = \frac{2}{3}(x - 1)$

$$\frac{3}{5}x + 2 = \frac{2}{3}x - \frac{2}{3}$$

$$9x + 30 = 10x - 10$$

$$\boxed{40 = x}$$

d) $\frac{4(x+1)}{5} = \frac{2}{3}(x - 6)$

$$\frac{4(x+1)}{5} = \frac{2}{3}x - 4$$

$$12(x+1) = 10x - 60$$

$$12x + 12 = 10x - 60$$

$$2x = -72$$

$$\boxed{x = -36}$$

2. Solve:

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

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

$$x - 3 = 0 \text{ or } x + 2 = 0$$

$$x = 3 \quad x = -2$$

solutions: $\{-2; 3\}$

c) $4(x + 2)^2 - 3 = 0$

$$4(x + 2)^2 = 3$$

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

$$x + 2 = \pm \sqrt{\frac{3}{4}}$$

$$\boxed{x = -2 \pm \frac{\sqrt{3}}{2}}$$

b) $12x^2 + 17x - 5 = 0$

$$\Delta = 17^2 - 4(12)(-5) = 529$$

$$x = \frac{-17 \pm \sqrt{529}}{24}$$

$$x = \frac{-17 - 23}{24} = -\frac{5}{3} \text{ or } x = \frac{-17 + 23}{24} = \frac{1}{4}$$

solutions: $\{-\frac{5}{3}; \frac{1}{4}\}$

d) $(x + 1)(x - 2) = 3$

$$x^2 - 2x + x - 2 - 3 = 0$$

$$x^2 - x - 5 = 0$$

$$\Delta = 1 - 4(-5) = 21$$

$$\boxed{x = \frac{1 \pm \sqrt{21}}{2}}$$

3. Solve algebraically (and verify with your graphing calculator – sketch what you would do to solve it graphically without technology for a) and b)).

a) $|x - 10| = x^2 - 10x$

$x - 10 = x^2 - 10x$ $-x + 10 = x^2 - 10x$
 $x^2 - 11x + 10 = 0$ $x^2 - 9x - 10 = 0$
 $(x - 10)(x - 1) = 0$ $\Delta = 81 - 4(-10) = 121$
 $x = 10$ $x = 1$ $x = -1$ $x = 10$

$ x-10 =x^2-10x$	$ x-10 =x^2-10x$	$ x-10 =x^2-10x$	$ x-10 =x^2-10x$
0 0	9 -9	11 11	0 0
✓	x	✓	✓

Solutions: $\{-1; 10\}$

c) $\frac{-3x}{x-1} + 6 = \frac{6x-9}{x-1}$

Restrictions: $x \neq 1$
 $\frac{-3x}{x-1} + \frac{6(x-1)}{x-1} = \frac{6x-9}{x-1}$
 $-3x + 6x - 6 = 6x - 9$
 $9 = 3x$
 $x = 3$ ✗ Restr.
 \Rightarrow no solution

e) $5 + \sqrt{3x - 5} = x$

restrictions: $3x - 5 \geq 0$
 $x \geq 5/3$

$\sqrt{3x - 5} = x - 5$
 $3x - 5 = x^2 - 10x + 25$
 $x^2 - 13x + 30 = 0$
 $(x - 10)(x - 3) = 0$

$x = 10$ $x = 3$ Restr ✓

$5 + \sqrt{3x-5} = x$	$5 + \sqrt{3x-5} = x$
$5 + \sqrt{30-5} = 10$	$5 + \sqrt{9-5} = 3$
10 10 ✓	7 3 ✗

Solution: $\{10\}$

b) $|2x - 5| = 5 - 3x$

$2x - 5 = 5 - 3x$ $-2x + 5 = 5 - 3x$
 $5x = 10$ $x = 0$
 $x = 2$

$ 2x-5 =5-3x$	$ 2x-5 =5-3x$
14-5 5-6	5 5 ✓
1 -1 ✗	


Solution: $\{0\}$

d) $\frac{6}{x-3} = \frac{x+3}{x^2-9} - 5$

Restrictions: $x - 3 \neq 0$ $x^2 - 9 \neq 0$
 $(x+3)(x-3) \neq 0$
 $D = \mathbb{R} \setminus \{\pm 3\}$

$6(x+3) = x+3 - 5(x^2-9)$
 $6x + 18 = x + 3 - 5x^2 + 45$
 $5x^2 + 5x - 30 = 0$ $5(x+3)(x-2) = 0$
 $5(x^2 + x - 6) = 0$ $x = -3$ Restr $x = 2$

f) $\sqrt{x^2 - 30x} = 8$

restrictions: $x^2 - 30x \geq 0$

 $D = (-\infty; 0] \cup [30; +\infty)$

$x^2 - 30x = 64$
 $x^2 - 30x - 64 = 0$
 $\Delta = 1156$
 $x = \frac{30 \pm 34}{2}$

$x = -2$

$\sqrt{x^2-30x} = 8$	$\sqrt{x^2-30x} = 8$
8 8 ✓	

$x = 32$

$\sqrt{x^2-30x} = 8$	$\sqrt{x^2-30x} = 8$
8 8 ✓	

Solutions: $\{-2; 32\}$