

**Solutions Algebra-1**  
**Basic Algebraic operations**

**Evaluation**

1.  $30 - 3(-1)^2(-6) = 48$

**Simplification**

2.  $12x - 8 - 20x - 5 \rightarrow -8x - 13$

3.  $6a^2 - 15ab - 2ab + 5b^2 \rightarrow 6a^2 - 17ab + 5b^2$

4.  $2x^2 + 6x - x - 3 + x^2 - 8x + 16$   
 $\rightarrow 3x^2 - 3x + 13$

5.  $(3y - 4)(3y - 4) \rightarrow 9y^2 - 24y + 16$

6. 

	$3x^2$	$4x$	$-1$
$2x$	$6x^3$	$8x^x$	$-2x$
$-3$	$-9x^2$	$-12x$	$3$

  
 $\rightarrow 6x^3 - x^2 - 14x + 3$

7.  $3x(2x - 3)$

8.  $(2a + 3b)(2a - 3b)$

9. a)  $(3x + y)(3x - y)$

b)  $\frac{6x+2y}{9x^2-y^2} \rightarrow \frac{2(3x+y)}{(3x+y)(3x-y)} \rightarrow \frac{2}{3x-y}$

10. a)  $(a + 3b)(a - 3b)$

b)  $\frac{a^2-9b^2}{2a+6b} \rightarrow \frac{(a+3b)(a-3b)}{2(a+3b)} \rightarrow \frac{a-3b}{2}$

11. a)  $(x + 3)(x - 3)$

b)  $\frac{4(5x+3)}{25x^2-9} \rightarrow \frac{4(5x+3)}{(5x+3)(5x-3)} \rightarrow \frac{4}{5x-3}$

12.  $\frac{15x-20}{9x^2-16} \rightarrow \frac{5(3x-4)}{(3x+4)(3x-4)} \rightarrow \frac{5}{3x+4}$

13. a)  $2x(x - 3)$

b)  $\frac{2x^2-6x}{x^2-9} \rightarrow \frac{2x(x-3)}{(x+3)(x-3)} \rightarrow \frac{2x}{x+3}$

14.  $3x^2 - 13x - 10 \rightarrow (3x + 2)(x - 5)$

15.  $5 - 2 - 6x = 27 \quad -24 = 6x \quad x = -4$

16.  $5 + 3a = a - 15 \quad 2a = -20 \quad a = -10$

17.  $2a + 4b = -7 \dots (1)$  multiply (1) x 5 and (2) x 4  
 $3a - 5b = 17 \dots (2)$

then add to get  $a = 1\frac{1}{2}$ , subst. to get  $b = -2\frac{1}{2}$

18.  $5a + 3b = 9 \dots (1)$  multiply (1) x 2 and (2) x 3  
 $7a - 2b = 25 \dots (2)$

then add to get  $a = 3$ , subst. to get  $b = -2$

**Functions**

1.  $f(-2) = (-2)^2 - 2(-2) \rightarrow 4 + 4 \rightarrow 8$

2.  $h(-2) = 15(-2) - 3(-2)^2 \rightarrow -30 - 12 \rightarrow -42$

3.  $f(-3) = \frac{(-3)^3 + (-3)^2 + 2}{5(-3) - 1} \rightarrow \frac{-27 + 9 + 11}{-16} \rightarrow \frac{7}{16}$

4. a)  $f(-3) = 9 - 6(-3) \rightarrow 9 + 18 \rightarrow 27$

b)  $f(t) = 9 - 6t \quad 11 = 9 - 6t \quad 6t = -2 \quad t = -\frac{1}{3}$

5. a)  $f(-2) = 3(-2)^2 - 7 \rightarrow 12 - 7 \rightarrow 5$

b)  $f(a) = 3a^2 - 7 \quad 20 = 3a^2 - 7 \quad 3a^2 = 27$   
 $a^2 = 9 \quad a = 3 \text{ or } a = -3$

6.  $f\left(\frac{1}{2}\right) = \frac{4}{\left(\frac{1}{2}\right)^2} \rightarrow \frac{4}{\frac{1}{4}} \rightarrow 4 \div \frac{1}{4} \rightarrow 4 \times \frac{4}{1} \rightarrow 16$

7. a)  $f(x) = 3^x \quad f(4) = 3^4 \rightarrow 81$

b)  $\sqrt{27} = 3^x, \quad (3^3)^{\frac{1}{2}} = 3^x \quad 3^{\frac{3}{2}} = 3^x \quad \therefore x = \frac{3}{2}$

8.  $f(2) = \frac{3}{\sqrt{2}} \rightarrow \frac{3}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} \rightarrow \frac{3\sqrt{2}}{2}$

9.  $f(12) = 3\sqrt{12} \rightarrow 3\sqrt{4 \times 3} \rightarrow 3\sqrt{4}\sqrt{3} \rightarrow 6\sqrt{3}$

**Quadratic Equations**

1.  $x^2 - 7x = 0 \rightarrow x(x - 7) = 0 \quad x = 0, x = 7$

2.  $6y - y^2 = 0 \quad y(6 - y) = 0 \quad y = 0, y = 6$

3.  $(2x + 1)(x - 5) = 0 \quad x = -\frac{1}{2}, x = 5$

4.  $(2x - 3)(x + 5) = 0 \quad x = \frac{3}{2}, x = -5$

5.  $(2x - 3)(x + 4) = 0 \quad x = \frac{3}{2}, x = -4$

6.  $(2p - 5)(p + 2) = 0 \quad p = \frac{5}{2}, x = -2$

7.  $5x + 3 = x^2 + 2x - 1 \rightarrow x^2 - 3x - 4 = 0$   
 $\rightarrow (x + 1)(x - 4) = 0 \rightarrow x = -1, x = 4$

## Solutions Algebra-1

### Basic Algebraic operations (continued)

### Quadratic Equations (continued)

8. Use formula  $a = 2$ ,  $b = -3$ ,  $c = -4$  :  $x = 2.4$ ,  $-0.9$

9. Use formula  $a = 1$ ,  $b = 2$ ,  $c = -6$  :  $x = 1.6$ ,  $-3.6$

### Inequalities

1.  $8 - x > 3(2x + 5) \rightarrow 8 - x > 6x + 15 \rightarrow x < -1$

2.  $3y < 4 - (y + 2) \rightarrow 3y < 2 - y \rightarrow y < \frac{1}{2}$

3.  $3 - x + 6 < 2x \rightarrow 9 < 3x \rightarrow x > 9$

4.  $6x - 2 < 5 - 15x \rightarrow 21x < 7 \rightarrow x < \frac{1}{3}$

5.  $2 + 5x \geq 8x - 16 \rightarrow 18 \geq 3x \rightarrow x \leq 6$

6.  $2 - 15x + 10 \geq 4 - 12x \rightarrow 12 - 15x \geq 4 - 12x$   
 $\rightarrow 8 \geq 3x \rightarrow x \leq \frac{8}{3} \quad x \leq 2\frac{2}{3}$

$x = 1$  or  $2$  since  $x$  is a positive integer.

7.  $3x + 1 \leq 5x + 3 \quad -2 \leq x \quad \text{i.e.} \quad x \geq -2$

$5x + 3 \leq x + 23 \quad 4x \leq 20 \quad \text{i.e.} \quad x \leq 5$

Both are true, so  $x = \{-2, -1, 0, 1, 2, 3, 4, 5\}$

### Changing subject of formula

1.  $5Y = 6v - 3w \rightarrow 6v = 5Y + 3w \rightarrow v = \frac{5Y + 3w}{6}$

2.  $3P = m - s \rightarrow m = 3P + s$

3.  $L - 8 = \frac{6}{Y} \rightarrow Y(L - 8) = 6 \quad Y = \frac{6}{L - 8}$

4.  $dt = k - m \rightarrow k = dt + m$

5.  $Q - p^2 = 3T \rightarrow T = \frac{Q - p^2}{3}$

6.  $M + 3 = R^2t \rightarrow \frac{M + 3}{t} = R^2 \rightarrow \sqrt{\frac{M + 3}{t}} = R$

7.  $A^2 = 4b^2 - c \rightarrow A^2 + c = 4b^2 \rightarrow b = \sqrt{\frac{A^2 + c}{4}}$

8. a)  $Q - t = 2\sqrt{s} \rightarrow \frac{Q - t}{2} = \sqrt{s} \rightarrow \left(\frac{Q - t}{2}\right)^2 = s$

b)  $s = \left(\frac{3.5 - 2.2}{2}\right)^2 \rightarrow \left(\frac{1.3}{2}\right)^2 \rightarrow 0.65^2 \rightarrow 0.4225$

9.  $F = f - \frac{fv}{s} \rightarrow \frac{fv}{s} = f - F \rightarrow fv = s(f - F) \rightarrow v = \frac{s(f - F)}{f}$

## Algebraic Fractions

1.  $\frac{1}{2x} - \frac{1}{3x} \rightarrow \frac{3}{6x} - \frac{2}{6x} \rightarrow \frac{1}{6x}$

2.  $\frac{3}{x} + \frac{2-x}{x^2} \rightarrow \frac{3x}{x^2} + \frac{2-x}{x^2} \rightarrow \frac{4x-2}{x^2}$

3.  $\rightarrow \frac{5(x-2)}{x(x-2)} - \frac{3x}{x(x-2)} \rightarrow \frac{2x-10}{x(x-2)} \rightarrow \frac{2(x-5)}{x(x-2)}$

## Fraction Equations

1.  $\frac{2x+1}{3} - \frac{x}{4} = 2 \rightarrow 4(2x+1) - 3x = 24 \rightarrow x = 4$

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

3.  $3x - \frac{5x+2}{2} = 3 \rightarrow 6x - 5x - 2 = 6 \rightarrow x = 8$

4.  $\frac{x-3}{2} + \frac{2x-1}{3} = 4 \rightarrow 3(x-3) + 2(2x-1) = 24 \rightarrow x = 5$

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

6.  $\frac{x}{2} - \frac{x+1}{3} = 4 \rightarrow 3x - 2(x+1) = 24 \rightarrow x = 26$

7.  $\frac{m}{3} = \frac{1-m}{5} \rightarrow 5m = 3 - 3m \rightarrow m = \frac{3}{8}$

## Indices

1. 9      2.  $y^2$       3.  $a^{-4} + 5a^3$       4.  $2y^3$

5.  $y^3$       6. b      7.  $b + 1$       8.  $a^{\frac{3}{2}} + a^{-\frac{1}{2}}$

## Surds

1.  $5\sqrt{2}$       2.  $2\sqrt{6}$       3.  $\sqrt{3}$       4.  $3\sqrt{2}$

5.  $10\sqrt{2}$       6.  $6\sqrt{2}$       7.  $2\sqrt{3} - 2$

8.  $f(12) = 3\sqrt{12} \rightarrow 3\sqrt{4 \times 3} \rightarrow 3\sqrt{4}\sqrt{3} \rightarrow 6\sqrt{3}$

9.  $\frac{3}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \rightarrow \frac{3\sqrt{5}}{5}$

10.  $\sqrt{\frac{3}{24}} \rightarrow \sqrt{\frac{1}{8}} \rightarrow \frac{1}{\sqrt{4 \times 2}} \rightarrow \frac{1}{2\sqrt{2}} \rightarrow \frac{1}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} \rightarrow \frac{\sqrt{2}}{4}$

11.  $f(2) = \frac{3}{\sqrt{2}} \rightarrow \frac{3\sqrt{2}}{\sqrt{2}\sqrt{2}} \rightarrow \frac{3\sqrt{2}}{2}$

12.  $f\left(\frac{3}{2}\right) = 4^{\frac{3}{2}} \rightarrow (\sqrt{4})^3 \rightarrow 2^3 \rightarrow 8$