**SOLVING EQUATIONS AND INEQUALITIES**

**(some of which have other unknowns).**

In solving linear equations and inequalities, **there are only 4 processes which we need to apply:**

We can **ADD** something to **both sides**,

**SUBTRACT** something from **both sides**,

**MULTIPLY** **both sides** by something or **DIVIDE** **both sides** by something.

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Find ***x*** in the four fundamental cases:

***1(a) x + 8 = 12***

***(b) x + k = w***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***2(a) x – 6 > 18***

***(b) x – k > w***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***3(a) 4x = 12***

***(b) kx = w***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***4(a) x < 8***

 ***4***

 ***(b) x < w***

 ***k***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

Use **combinations** of the above four techniques to solve the following equations or inequalities to find the ***x*** values.

***5(a) 5x + 3 = 11***

 ***(b) px + v = m***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***6(a) x – 4 ≤ 3***

 ***2***

 ***(b) x – t ≤ v***

 ***c***

***7(a) 7x – 4 = 3x + 11***

 ***(b) cx – b = nx + p***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***8(a) 5(x + 4) ≥ 3(x – 9)***

***(b) p(x + c) ≥ v(x – d)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***9(a) 5(x + 3) + 2(x + 4) = 2(x + 15)***

 ***(b) c(x + p) + b(x + v) = d(x + a)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***10(a) 7(x – 2) – 3(x – 4) < 2(x – 5)***

 ***(b) a(x – b) – c(x – d) < e(x – f)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***11(a) x + 5 > 7***

 ***2 3***

 ***(b) x + v > p***

 ***5 2***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***12(a) 15 = 3***

 ***(x – 2)***

 ***(b) p = c***

 ***(x – b)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***13(a) 12 = 4***

 ***(x + 4) x***

 ***(b) b = c***

 ***(x + v) x***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***14(a) 7 = 9 .***

 ***(x + 2) (x – 3)***

 ***(b) b = c .***

 ***(x + v) (x – m)***

**MODEL SOLUTIONS**

Find ***x*** in the four fundamental cases:

***1(a) x + 8 = 12 (subtract 8 from b.s.)***

 ***x = 4***

***(b) x + k = w (subtract k from b.s.)***

 ***x = w – k***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***2(a) x – 6 > 18 (add 6 to b.s.)***

 ***x > 24***

***(b) x – k > w (add k to b.s.)***

 ***x > w + k***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***3(a) 4x = 12 (divide b.s. by 4)***

 ***x = 3***

***(b) kx = w (divide b.s. by k)***

 ***x = w***

 ***k***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***4(a) x < 8 (multiply b.s. by 4)***

 ***4***

 ***x < 32***

 ***(b) x < w (multiply b.s. by k)***

 ***k***

 ***x < kw***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

Use **combinations** of the above four techniques to solve the following equations or inequalities to find the ***x*** values.

***5(a) 5x + 3 = 11***

 ***5x = 8***

 ***x = 8***

 ***5***

***(b) px + v = m***

 ***px = m – v***

 ***x = m – v***

 ***p***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***6(a) x – 4 ≤ 3***

 ***2***

 ***x ≤ 7***

 ***2***

 ***x ≤ 14***

 ***(b) x – t ≤ v***

 ***c***

 ***x ≤ v + t***

 ***c***

 ***x ≤ c(v + t)***

***7(a) 7x – 4 = 3x + 11***

 ***4x – 4 = 11***

 ***4x = 15***

 ***x = 15***

 ***4***

***(b) cx – b = nx + p***

 ***(c – n)x – b = p***

 ***(c – n)x = p + b***

 ***x = p + b***

 ***( c – n)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***8(a) 5(x + 4) ≥ 3(x – 9)***

 ***5x + 20 ≥ 3x – 27***

 ***2x + 20 ≥ - 27***

 ***2x ≥ - 47***

 ***x ≥ - 47***

 ***2***

***(b) p(x + c) ≥ v(x – d)***

 ***px + pc ≥ vx – vd***

***(p – v)x + pc ≥ - vd***

 ***(p – v)x ≥ - vd – pc***

 ***x ≥ -vd – pc***

 ***(p – v)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***9(a) 5(x + 3) + 2(x + 4) = 2(x + 15)***

 ***5x + 15 + 2x + 8 = 2x + 30***

 ***5x + 23 = 30***

 ***5x = 7***

 ***x = 7***

 ***5***

 ***(b) c(x + p) + b(x + v) = d(x + a)***

 ***cx + cp + bx + bv = dx + da***

 ***cx + bx – dx = da – cp – bv***

 ***x(c + b – d) = da – cp – bv***

 ***x = da – cp – bv***

 ***(c + b – d) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***10(a) 7(x – 2) – 3(x – 4) < 2(x – 5)***

 ***7x – 14 – 3x + 12 < 2x – 10***

 ***7x – 3x – 2x < - 10 + 14 - 12***

 ***2x < - 8***

 ***x < - 4***

 ***(b) a(x – b) – c(x – d) < e(x – f)***

 ***ax – ab – cx + cd < ex – ef***

 ***ax – cx – ex < - ef + ab – cd***

 ***x(a – c – e) < - ef + ab – cd***

 ***x < -ef + ab – cd***

 ***(a – c – e )***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***11(a) x + 5 > 7***

 ***2 3***

 ***6 ( x + 5 ) > 6× 7***

 ***2 3***

 ***3x + 10 > 42***

 ***3x > 32***

 ***x > 32***

 ***3***

 ***(b) x + v > p***

 ***5 2***

 ***10( x + v ) > 10p***

 ***5 2***

 ***2x + 5v > 10p***

 ***2x > 10p – 5v***

 ***x > 10p – 5v***

 ***2***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***12(a) 15 = 3***

 ***(x – 2)***

 ***15 = x – 2***

 ***3***

 ***5 = x – 2***

 ***7 = x***

 ***(b) p = c***

 ***(x – b)***

 ***p = x – b***

 ***c***

 ***p + b = x***

 ***c***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***13(a) 12 = 4***

 ***(x + 4) x***

 ***12x = 4x + 16***

 ***8x = 16***

 ***x = 2***

 ***(b) b = c***

 ***(x + v) x***

 ***bx = cx + cv***

 ***bx – cx = cv***

 ***x(b – c) = cv***

 ***x = cv ,***

 ***(b – c)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***14(a) 7 = 9 .***

 ***(x + 2) (x – 3)***

 ***7x – 21 = 9x + 18***

 ***- 21 = 2x + 18***

 ***- 39 = 2x***

 ***- 39 = x***

 ***2***

 ***(b) b = c .***

 ***(x + v) (x – m)***

***bx – bm = cx + cv***

***bx – cx = cv + bm***

***x(b – c) = cv + bm***

 ***x = cv + bm***

 ***(b – c)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***