MATHS FOR INTRODUCTORY ACCOUNTING:

SOLVING LINEAR EQUATIONS

Transposition

There are many equations in Accounting, Business and Economics that describe the relationship between variable quantities. The variable on the left hand side is called the subject of the equation. If we know the value of the variables on the right hand side of the equation we can substitute and find the value of the subject. The variable may be a letter, symbol or word.
Some examples are:

A = L + E [A is the subject]

Profit = Income – Expenses [Profit is the subject]

TR = P x Q [TR is the subject]

Assets = Current Assets + Noncurrent Assets [Assets is the subject]

Any variable in an equation may be evaluated if the values of the others are known. But we need to first rearrange the equation to make the variable we wish to evaluate the subject.
For example:

A= L + E can be rearranged to make E the subject: E = A - L

To be able to rearrange any equation we may perform whichever operations we choose providing we do the *same to each side of the equation*. Study the following examples in which each simple equation is rearranged to make 'A' the subject.

(i) A + B = C

A + B - B = C - B [- B both sides]

therefore A = C - B

(ii) A - B = C

A - B + B = C + B [+ B both sides]

therefore A = C + B

(iii) A x B = C

$\frac{A \times B}{B} = \frac{C}{B}$ [÷ B both sides]

$A = \frac{C}{B}$

(iv) $\frac{A}{B} = C$

$\frac{A}{B} \times B = C \times B$ [xB both sides]

therefore A = C x B

Notice that - 'undoes' + and + 'undoes' -

÷ ' undoes' x and x 'undoes' ÷

Examples

1. *Rearrange to* m*ake Q the subject of P = 20 - Q*

   P = 20 – Q

   P + Q = 20 – Q + Q [add Q both sides to remove (-) sign]

   P + Q = 20 [simplify]

   P – P + Q = 20 – P [subtract P both sides]

   Q = 20 – P [simplify]

2. *Rearrange A = L + E to make L the subject*

   A = L + E

   A – E= L [subtract E from both sides]

   L = A - E [rewriting the equation put L on the left hand side]

3. *Make E the subject of 5000 = 1400 + E*

   5000 = 1400 + E

   5000 – 1400 = E [subtract 1400 from both sides]

   3600 = *E* [simplify]

   E = 3600

4. *Make C the subject of the equation B + C + 50 = D*

   B *+ C + 50 = D*

   B+C = D – 50 [subtract 50 from both sides]

   C = D – 50 – B [subtract B from both sides]

See exercise 1.

Substitution

The process of replacing a *variable* (or pronumeral or letter) in an equation with a specific value is called ***substitution***.
Within a particular problem once a value has been allocated to a variable, eg A = 5000, then whenever A appears in that problem we give it the value 5000. For subsequent problems the value of the variable may change (or vary!).

When all known variables have been allocated values it is then possible to ***solve*** an equation for the unknown variable.

Examples

1. Evaluate a + b if a = 6 and b = 3
   a+b = 6 + 3
   =9
2. Evaluate 100 + b – c if b = 25 and c = 30
   100 + b – c = 100 + 25 – 30
   =95

Solving linear equations

Equations with one variable may be solved using transposition skills to make the variable the subject of the equation.

Examples

1. $m - 4 = -7$

   $m - 4 + 4 = -7 + 4$ [add 4 both sides]

   $m = -3$

2. Profit + $1500 = $4000

   Profit + $1500 – $1500 = $4000 – $1500 [subtract $1500 both sides]

   Profit = $2500

3 Assets = $5000, Liabilities = $1500, Opening Equity = $500, and Expenses = $1000.

Use the equation: Assets = Liabilities + Opening Equity + Income – Expenses to find Income.

Assets = Liabilities + Opening Equity + Income – Expenses [write the equation]

5000 = 1500 + 500 + Income – 1000 [substitute values in equation]

5000 = 1000 + Income [1500 + 500 - 1000 = 1000]

5000 – 1000 = Income [subtract 1000 both sides]

4000 = Income

Income = $4000

4. Use the equation $a + b = c + d – e$, to calculate e, given a = 50, b= 20, c = 40. and d = 55

$a + b = c + d – e$

$50 + 20 = 40 + 55 – e$ [substitute values in equation]

$70 = 95 – e$ [50 + 20 = 70, and 40 - 55 = 95]

$70 + e = 95$ [add e both sides]

$e = 95 – 70$ [subtract 70 both sides]

$e = 25$

*Accounting examples

5. Assets (A) = Liabilities (L) + Owners Equity (OE)

A = $13 000

L = $10 000

OE = unknown (?)

A = L + OE [write out original equation]

OE = A – L [transpose equation to find the unknown, OE]

= 13 000 – 10 000 [substitute numbers and solve to find 'OE']

OE = $3 000

6. Extract : Liabilitiies section of balance sheet.

Current Liabilites	
Accounts Payable (AP)	$3000
Wages (W)	$1000
Loan Payment for period (LP)	$10 000
Interest Payable (IP)	? unknown?
Noncurrent Liabilities	
Loan NAB (Loan Principle)	$100 000
Total liabilities	$120 000

AP + W + LP + IP + Loan Principal = $120 000 [write out the equation]

IP = 120 000 – AP – W – LP – Loan Principal [transpose to find IP (interest payable)]

IP = 120 000 – 3 000 – 1 000 – 10 000 – 100 000 [substitute umbers into the equation]

IP = 6 000

Interest payable = $6 000

* The SLC acknowledges these worked examples provided by SLAMS

Exercises

Exercise 1

Rearrange each of the following expressions to make the variable in brackets the subject

a. A = L + E (E)

b. R = S – T (S)

c. Assets = Liabilities + Equity (Liabilities)

d. A + B =C + D + E + F (B)

e. m + n = 250 + a – b (b)

Exercise 2

Evaluate the following –

a. X + Y, if X = 35 and Y =40

b. a – b, if a = 12 and b = 20

c. Current liabilities + Noncurrent liabilities, if Current liabilities = 250 and Noncurrent liabilities = 300

d. m + n + p – q, if m = 2000, n = 1500, p = 600 and q = 1200

e. A + B – C + 30 – D, if A =15, B = – 8, C = 5 and D = 10

Exercise 3

1. Solve the following equations

a. x + 4 = 7 b. a – 3 = 12 c. 20 – d = 5 d. A + 1200 = 2000 + 300

2. Find the value of the unknown in the following equations

a. 2000 = 1000 + a + 500 +100

b. 1200 = 900 + 600 – E

c. 1500 + b = 2000 + 300 – 150

d. 9000 + 1500 = 6000 + 1000 +x – 250

e. 200 + 1000 = 100 + 0 + c + 50

f. 5000 + 2500 = 1500 + N + 1000 – 2000 – 100

g. 200 + 300 = 100 + 500 + 1000 – E – 200

Answers

Exercise 1

a. $E = A - L$

b. $S = R + T$

c. Liabilities $=$ Assets $-$ Equity

d. $B = C + D + E + F - A$

e. $b = 250 + a - m - 500$

Exercise 2

a. 75 b. -8 c. 550 d. 2900 e. 22

Exercise 3

1 a. $x = 3$, b. $a = 15$, c. $d = 15$ d. $A = 1100$

2 a. $a = 400$, b. $E = 300$, c. $b = 650$, d. $x = 3750$, e. $c = 1050$, f. $N = 7100$ g. $E = 900$