4 Ratios and Proportions

**Exercise 4.1**

a) 5:75 = 1:15 (each term divided by 5)

c) 0.2:0.8 = 2:8 (each term multiplied by 10)

= 1:4 (each term divided by 2)

e) = 2:1 (each term multiplied by 4)

g) 25:2.5 = 10:1 (each term divided by 2.5)

i) 1.5:0.25 (each term converted to a decimal)

= 150:25 (each term multiplied by 100)

= 6:1 (each term divided by 25)

k) Poodle:Chihuahua:German Shepherd = 28:4:48

= 7:1:12 (each term divided by 4)

1. 12:64 = 3:16 (each term divided by 4)

3. 45:15:30 = 9:3:6 (each term divided by 5)

= 3:1:2 (each term divided by 3)

5. 0.08 : 0.12 = 8:12 (each term multiplied by 100)

= 2:3 (each term divided by 4)

7. 0.84 : 1.4 : 1.96 = 84:140:196 (each term multiplied by 100)

= 21:35:49 (each term divided by 4)

= 3:5:7 (each term divided by 7)

9. 0.24 : 0.39 : 0.15 = 24:39:15 (each term multiplied by 100)

= 8:13:5 (each term divided by 3)

11. 

13. 

15. 1 = 15:20 = 3:4

17. = 15:8

19.  (each term multiplied by 15)

= 2:6:3 (each term multiplied by 2)

21. 7.6 : 3 =  (each term divided by 3)

23. 0.177 : 0.81 = 1 : 4.58 (each term divided by 0.177)

25. 

27. 77:23:41 = 3.35 : 1 : 1.78 (each term divided by 23)

29. 3.5 : 5.4 : 8 = 1 : 1.54 : 2.29 (each term divided by 3.5)

31. 

33. Ads : Clicks : Purchases = 15,000 : 1250 : 250 = 60 : 5 : 1

35. Cell Phone & Internet : Food : Rent & Utilities = 12%:22%:40% = 6:11:20

37. Debt : Preferred equity : Common equity

= ($3.6 – $0.55 – $1.2) : $0.55 : $1.2

= 1.85 : 0.55 : 1.2

= 3.36 : 1 : 2.18 (each term divided by 0.55)

39. Education : Health services : Social services

= $1.560 : $1.365 : $0.975

= $1560 : $1365 : $975 (each term multiplied by 1000)

= 312 : 273 : 195 (each term divided by $5)

= 104 : 91 : 65 (each term divided by 3)

= 8 : 7 : 5 (each term divided by 13)

41. Add 250 ml of oil to 5 L (= 5000 ml) of gasoline.

Gasoline : Oil = 5000 : 250

= 500: 25 (each term divided by 10)

= 20 : 1 (each term divided by 25)

43. Bounces : Visitors = 62.5 : 100

= 625 : 1000 (each term multiplied by 10)

= 5 : 8 (each term divided by 125)

**Exercise 4.2**

a. 7:2 = 21 : x

7x = 21(2)

7x = 42

x = 6

c. 5 : 15 : 50 = 3 : j : k

and

5j = 15(3) and 5k = 50(3)

5j = 45 and 5k = 150

j = 9 and k = 30

e. Servings:Tomatoes = 6 : 3

6 : 3 = 2 : T

6T = 2(3)

T = 1

1) 9:7 = 54:b



9b = 7(54)

b = 42.0

3) 88:17 = a:45



88(45) = 17a

a = 233

5) 1.89:0.31 = 175:k



7) 0.043:y = 550:198



9) 





11) 6:7:5 = n:105:m

 and 

 = 90.0 m =  = 75.0

13) 625:f:500 = g:3:4

 and 

g =  = 5.00 f =  = 375

15) 0.69:1.17:0.4 = r:s:6.5

 and 

r =  = 11.2 s =  = 19.0

17) Let the taxes on the new property be T.

If Tax1 : Tax2 = Value1 : Value2

Then 

That is, T =  = $4723.06

The estimated property taxes are $4723.06.

19) Let P represent the PVR’s total recording time.



P = = 31.11 hours

0.11 hr = 0.11 hr  = 7 minutes to the nearest minute

The maximum duration of high-definition recording is 31 hours and 7 minutes.

21) Let the expected hours of direct labour be H.



H =  = 1035

Total budget for direct labour = 1035($31.50) = $32,602.50.

23) Let the first quarter sales of Samsung be S, let the sales of Apple be A and the sales of Huawei be H. Then S : A : H = 21 : 14 : 11 and sales for Huawei = 40.4M units.

and

A = S =

=51.4 million units = 77.1 million units

The first quarter sales for Apple will be 51.4 million units and for Samsung will be 77.1 million units.

25) Let S, W, and O represent sales, wholesale costs, and overhead expenses, respectively.

Then S:W:O = 3.66 : 2.15 : 1.13

If S = $5.03 million, then

 and  = 

W =  $5.03 million = $2.95 million

O =  $5.03 million = $1.55 million

Economart’s wholesale costs would have been $2.95 million and

its overhead expenses $1.55 million.

27) Let T, F and I represent the number of followers on Twitter, Facebook and Instagram.

For the Red Deer location,

T : F : I = 14,500 : 22,300 : 8,500 followers

For the Medicine Hat location F = 17,200 followers

If T and I maintain the same ratio for Medicine Hat as for Red Deer then,

and

Therefore, T = and I =

= 11,183.86 = 6,556.05

The Medicine Hat location will have 11,200 Twitter followers and 6,600 Instagram followers.

29) Let O, P, and S represent the number of outlets, population,

and annual sales. For the Hamilton market,

O:P:S = 59 : 675,000 : $66.67 million

For the Calgary market, P = 1,075,000. If O and S maintain the

same ratio for Calgary as for Hamilton,

 and 

Therefore, OC= 1,075,000 = 94 outlets

and SC= 1,075,000 = $106.18 million

Tom Nortons would need to add 94 – 65 = 29 outlets.

The projected increase in revenue is

$106.18 million – $63.05 million = $43.13 million.

31) Let the V represent the implied value of the entire partnership.

 of ainterest is worth $27,000.

V = $27,000

V =  × $27,000 = $105,000

*a.* The implied value of the entire partnership is $105,000.

*b.* The implied value of Shirley’s remaining interest is

V =  × $105,000 = $18,000

33)  of entrants complete Level 1.  of Level 1 completers fail Level 2.

587 students completed Level 2 last year.

Let the N represent the original number who began Level 1.

 of  of entrants will complete Level 2.

N = 587

N =  x 587 = 1056.6

1057 students began Level 1.

**Exercise 4.3**

a. Refund : Total Cost = Unused Screws : Total Screws

Refund = = $24

c. Allowances = Matt : Pat : Stanley = 1 : 3 : 6 = 10 portions

Matt’s current allowance = $9.00

Pat’s current allowance = $27.00

Stanley’s current allowance = $54.00

Once Stanley’s allowance is stopped there are now 4 portions.

Matt’s new allowance = $9.00 + = $22.50

Pat’s new allowance = $27.00 + = $67.50

1. Refund : Subscription price = Remaining issues : Total issues



Refund =  = $75.85

3. Refund : Two‑year fee = Remaining days : Total days



Refund = $1260 ×  = $1035.62

5. *a.* Office expenses : Total expenses = Rooms used for business : Total rooms



Office expenses =  = $3184.00

*b.* 

Office expenses =  = $3444.98

7. Andy’s share : Candy’s share : Sandy’s share : Total = 3:8:5:16

*a.* Andy’s cost =  = $513.56 per year = $42.80 per month

Candy’s cost =  = $1369.50 per year = $114.13 per month

Sandy’s cost =  = $855.94 per year = $71.33 per month

*b.* Andy’s allowance =  = 93.75 GB

Candy’s allowance =  = 250 GB

Sandy’s allowance =  = 156.25 GB

9. Let B, E, and J be the investments of Bella, Edward, and Jacob, respectively.

Let T represent the total investment.

We are given: B:E:J:T = 1 : 1.35 : 0.85 : 3.2

*a.* If T = $256,000, then



Therefore, B =  = $80,000

E =  = $108,000

J =  = $68,000

Bella contributed $80,000, Edward contributed $108,000,

and Jacob contributed $68,000.

*b.* Since E:J = 1.35 : 0.85,

Then  and E =  = $25,920

Edward’s investment was $25,920.

11. Total investment = $25,300,000 + $17,250,000 + $11,900,000 = $54,450,000

Total sales = $21,200,000 + $8,350,000 + $7,450,000 = $37,000,000

*a.* Industrial Products cost : Total costs = $25,300,000 : $54,450,000

Industrial Products cost =  = $389,838

Similarly, Fine Paper cost =  = $265,799

Containers & Packaging cost =  = $183,363

*b.* Industrial Products cost =  = $480,724

Fine Paper cost =  = $189,342

Containers & Packaging cost =  = $168,934

13. Mr. C did not reach the basic quota. C’s bonus = $0

The sales in excess of quota for Mr. A, Ms. B, and Ms. D are $410,000, $255,000,

and $115,000, respectively. The total of these excess sales is $780,000.

Mr. A’s bonus : Total bonus = Mr. A’s excess sales : Total excess sales

Mr. A’s bonus = $10,000 = $5256.41

Similarly, Ms. B’s bonus = $10,000 = $3269.23

Ms. D’s bonus = $10,000 = $1474.36

15. Profit to be allocated to the employees = $132,500

The *tota*l amount to be allocated to each employee group obeys the proportion:

Executive group : Supervisor group : Production group : Total

= (4 x 10):(8 x 7):(45 x 5):(4 x 10 + 8 x 7 + 45 x 5)

= 40 : 56 : 225 : 321

Hence,



Executive group’s allocation = = $16,510.90

Each executive will receive = $4127.73

Similarly,

Supervisor group’s allocation = = $23,115.26

Each supervisor will receive = $2889.41

Production group’s allocation = = $92,873.83

Each production worker will receive = $2063.86

# Exercise 4.4

1.  = 

C$c =  × US$1856 = C$2456.03

3.  = 

¥y =  × C$14,500 = ¥1,184,834.15

5.  = 

C$c =  × €3251= C$4960.57

7.  = 

C$c = × ¥756,000 = C$9251.93

9.  = 

£b = × C$94,350 = £55,853.31

11.  = 

€ *x* = × C$49,900 = €32,702.96

13. *a*.  =

Sw kr *x* = × C$1.00 = Sw kr 6.715

*b.* =

US$*x* = × *Ch renminbi* $1.00 = US$0.14721

*c.* = 

Mex peso *x* = × ¥1.00 = Mex peso 0.1777

*d.*  =

C$*x* = × Rupee 1.00 = C$0.01879

15.  = 

C$c = × £2000 = C$3378.50

With an additional 0.5% commission, the cost will be

 = C$3378.50(1.005) = C$3395.39

17.  = 

C$*x* = × ¥1,000,000 = C$12,238.00

After the 0.5% currency conversion fee, Keiko will have a balance of

 = C$12,238.00(1 – 0.005) = C$12,176.81

19. Cost of stock = 1200(¥1150) × = C$17,045.45

Proceeds of sale = 1200(¥1310) × = C$19,376.31

Marielle had a C$19,376.31 – C$17,045.45 = C$2330.86 gain.

21. The Royal Bank will sell £ at C$1.7569 per £. For C$2000, you will receive

C$2000  = £1138.37

ICE will sell £ at C$1.7591 per £. For C$2000, you will receive

(C$2000 − C$3.50)  = £1134.96

You will obtain £1138.37 − £1134.96 = £3.41 more from the Royal Bank.

23. ICE will buy US$ at C$1.2833 per US$. For US$165, you will receive

 − C$3.50 = C$208.24

The Royal Bank will buy US$ at C$1.2847 per US$. For US$165, you will receive

US$165  = C$211.98

You will receive C$211.98 − C$208.24 = C$3.74 less from ICE.

25. *a.* At the mid-rate, £250 would cost £250 = C$426.15

At the Royal Bank’s sell rate, you would pay £250 = C$439.23

The % transaction cost is  = 3.07% at the Royal Bank

At ICE’s sell rate, you would pay £250 + C$3.50= C$443.28

The % transaction cost is  = 4.02% at ICE.

*b.* At the mid-rate, £16 would sell for £16 = C$27.27

At the Royal Bank’s buy rate, you would receive £16 = C$26.65

The % transaction cost is  = 2.27% at the Royal Bank

At ICE’s buy rate, you would receive £16 − C$3.50= C$22.69

The % transaction cost is  = 16.80% at ICE.

27. Let €*x* represent the number of Euros.

Converting C$1150 directly to €,

 = 

€*x* = × C$1150 = €753.68

Converting C$1150 first to £,

 = 

£b = × C$1150 = £680.78

Converting £680.78 to €,

 = 

€*x* = × £680.78 = €753.76

To four-figure accuracy, the two outcomes are the same. (Since the exchange rates used

have 5-figure accuracy, we can expect only 4-figure accuracy in the calculated results.)

29. Given: US$3.53 buys 1 US gallon or 3.785 litres.

The price per litre in the United States is  = US$0.93263.

Converting this US$ price of 1 litre to C$,

 = 

C$c = × US$0.93263 = C$1.2341 per litre

In Canada, milk costs  = C$1.61 per litre

That is, milk is  = 23.35% more expensive in Canada.

31. The cost of the holiday under the first option is

2(US$2323) + ₤149 + 2(₤1950) = US$4646 + ₤4049

The cost of this option in C$ is

 = C$6148.01 + C$6839.77

= C$12,987.78

The cost of the alternative all-inclusive package is 2(C$7195) = C$14,390

Therefore, the personally designed travel is

C$14,390 − C$12,987.78 = C$1402.22 cheaper.

33. The Ontario price is = C$38.60 per litre

The C$ equivalent of US$27.00 (per 40 ounces) is US$27.00 = C$35.73

which buys 40 ounces ×  = 1.1364 litres

Therefore, the cost of duty-free rum works out to = C$31.44 per litre

The percent saving (based on the Ontario price) is  × 100% = 18.55%

**Concept Questions (Section 4.5)**

1. If the number of units of currency N per unit of currency M decreases, it then requires *less* of currency N to purchase 1 unit of M. Therefore, currency N has strengthened.

3. If currency G weakens relative to currency H, it will require more of currency G to purchase 1 unit of H. Therefore, the exchange rate expressed as units of G per unit of H will increase.

**Exercise 4.5**

1. Initially, C$1.00 = £0.59198

Finally, C$1.00 = £0.59198 + £0.054 = £0.64598

C$1.00 buys more £ after the change. Therefore, the C$ has appreciated

and the £ has depreciated from

 to 

That is, from C$1.6892 to C$1.5480

The percent change is  = –8.36%

3. Initially, C$1.00 buys €0.65537

If the C$ weakens by 0.5%, it will buy only

 = €0.65537(1 – 0.005) = €0.65209

The new exchange rates are

€0.65209 per C$1.00 and  = C$1.5335 per €1.00

5. Initially, C$1.68925 buys £1.00.

Finally, C$1.68925 – C$0.0017 = C$1.68755 buys £1.00.

C$1.00 will then buy £ = £0.5926

7. Initially, C$1.00 buys £0.59198.

Finally, C$1.00 buys £0.59198 + £0.0021 = £0.59408.

£1.00 will then buy C$ = C$1.6833

9. If the C$ per US$ exchange rate decreases from

C$1.32329 to C$1.32329 − C$0.005 = C$1.31829

then the US$ per C$ exchange rate increases from

US$ to US$

That is, from US$0.7557 to US$0.7586, an increase of US$0.0029.

11. If the ¥ per A$ exchange rate increases from ¥77.63975 to ¥78.63975,

then the A$ per ¥ exchange rate decreases from

A$ to A$

That is, from A$0.01288 to A$0.01272, a decrease of A$0.00016.

13. Initially, US$0.7588 = C$1.00

Finally, US$0.7889 = C$1.00

Initially,  = 

That is, C$ price = × US$1500 = C$1976.81

Finally, C$ price = × US$1500 = C$1901.38

Price change = C$1901.38 – C$1976.81 = -C$75.43

That is, a C$75.43 decrease.

15. Initially, £0.54182 = C$1.00

Finally, £0.55354 = C$1.00

Initially, = 

That is, C$ revenue = × £23,000 = C$42,449.52

Finally, C$ revenue = × £23,000 = C$41,550.75

Revenue change = C$41,550.75 – C$42,449.52 = – C$898.77

That is, a C$898.77 decrease.

**Exercise 4.6**

1. == 151.3

3. 



Current value = = $9001

5. == 9.374

7. 



Value on base date = = $3646

9. Ending122.20

11. In order to have the same purchasing power, the amount of money must increase in proportion to the CPI. Therefore,





Amount at the end = = $1024.46

13. Costs have increased in proportion to the respective index.

*a.* Goods cost = $1157.02 at the end of the 10-year period.

*b.* Services cost = $1209.03 at the end of the 10-year period.

*c*. Percent increase in the price level of Goods = = 15.70%.

Percent increase in the price level of Services = = 20.90%.

Services cost 20.90% more. Goods cost 15.70% more.

The cost of services rose 20.90% – 15.70% = 5.20% more than the cost of goods.

15. Consumer prices rose by = 67.29%

Portfolio rose by = 358.67%

17. *a.* To maintain purchasing power, the amount of money must increase in proportion to the CPI.



Amount (1983) = = $161.16

*b.* Inflation rate = Percent change in the CPI

Inflation rate (1978) = 

= 

= 8.90%

Inflation rate (1979) =  = 9.60%

Inflation rate (1980) =  = 11.95%

Inflation rate (1981) =  = 11.42%

Inflation rate (1982) =  = 8.25%

**Review Problems**

1. *a*. 0.18 : 0.60 : 0.45 = 18:60:45 (each term multiplied by 100)

= 6:20:15 (each term divided by 3)

*b.*  (each term multiplied by 8)

= 3:2:4 (each term divided by 3)

*c.*  (each term multiplied by 6)

= 3:6:2 (each term multiplied by 3)

*d.* = 25:20:35 (each term multiplied by 4)

= 5:4:7 (each term divided by 5)

3. *a*. 65:43 = 27.3 : *x*



65*x* = 43(27.3)

*x* = 18.06

*b.* 1410 : 2330 : 870 = a:550:b

 and 

a =  = 332.8 b =  = 205.4

5. Initially, Milan : Katka : Shoshanna : $135,000 = 3:4:2:9



Milan’s investment = = $45,000

We similarly obtain

Katka’s investment = $60,000 and Shoshanna’s investment = $30,000.

After each partner contributes an additional $10,000,

Milan : Katka : Shoshanna = $55,000 : $70,000 : $40,000 = 11:14:8

7. To maintain purchasing power,



New rate =  = $23.10 per hour

9. 

rupiah *x* = = rupiah 13,380,910

11. Initially, ¥87.94 = C$1.00; Finally, ¥89.78 = C$1.00

Initially,  = 

That is, C$ price = × ¥2,965,000 = C$33,716.17

Finally, C$ price = × ¥2,965,000 = C$33,025.17

Price change = C$33,716.17 – C$33,025.17 = C$691.00 decrease.

13. 

C$ purchase price = = C$385.92

C$ selling price = = C$394.94

The Percivals gained C$394.94 – C$385.92 = C$9.02

15. We are given L:M:N:P = 1.5 : 1.0 : 0.75 : 0.5

If N = $2000, then L:$2000 = 1.5 : 0.75 and

= $4000

Similarly, M = $2666.67 and P = $1333.33.

Ms. L received $4000, Mr. M received $2666.67, and Mr. P received $1333.33.

17. Let W, S, and SS represent the wife’s, son’s, and stepson’s shares, respectively. Then,

W:S:SS =  = 49:35:25 (after multiplying by 35)

For a total distribution of $331,000,

W:S:SS:$331,000 = 49:35:25:(49 + 35 + 25)

Therefore,

 and

W = = $148,798.17

Similarly, S = $106,284.40 and SS = $75,917.43.

Rounded to the nearest dollar, Mrs. Nolan will receive $148,798, the son will

receive $106,284, and the stepson will receive $75,917.

19. Initially, US$1.3358 = C$1.00

Finally, US$1.3112 = C$1.00

Initially,  = 

That is, C$ price = × US$2000 = C$1497.23

Finally, C$ price = × US$2000 = C$1525.32

Price change = C$1525.32 – C$1497.23 = C$28.09 increase

21. Price of West Virginia coal =  = = 

Price of West Virginia coal in C$ =  = C$130.11 per metric ton

It is C$130.11 – C$105.00 = C$25.11 per metric tonne cheaper to purchase Alberta coal.

**Case (Chapter 4)**

***Calculations for an Investment Portfolio***

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Number owned | Unit purchase price | Initial investment (C$) |
| BMO | 300 units | C$54.20 | 300(C$54.20) = C$16,260.00 |
| GoCs | 6 bonds | C$1063.00 | 6(C$1063.00) = C$6378.00 |
| IBM | 100 units | US$125.50 | 100(US$125.50) = C$13,422.46 |
| GE | 200 shares | US$18.57 | 200(US$18.57)  = C$3972.19 |

The total amount of the securities is $40,032.65.

3. Current value of securities

= 300(C$58.15) + 6(C$1021.50) + [100(US$132.25) + 200(US$20.38)] × 

= C$17,445.00 + C$6129.00 + C$18,173.32

= C$41,747.32