2 Review and Applications of Algebra

**Exercise 2.1**

a. (– p) + (– 3p) + (4p) = – p – 3p + 4p = 0

c. 4x2y – 3x2y +(-5x2y) = 4x2y – 3x2y - 5x2y = -4x2y

e. 4x2y+ (– 3x2y) – ( – 5x2y) = 4x2y – 3x2y + 5x2y = 6x2y

g. (6x2 – 3xy + 4y2) – (8y2 – 10xy – x2) = 6x2 – 3xy + 4y2 – 8y2 + 10xy + x2

= 7x2 + 7xy – 4y2

i. 2(7x – 3y) – 3(2x – 3y) = 14x – 6y – 6x + 9y = 8x + 3y

k. 15x – [4 – 5x – 6] = 15x – 4 + 5x + 6 = 20x + 2

m. 15x –  = 15x – 4 + 10x – 12 = 25x – 16

o. 4a(3ab – 5a + 6b) = 12a2b – 20a2 + 24ab

q. – 5xy(2x2 – xy – 3y2) = – 10x3y + 5x2y2 + 15xy3

s. (4r – 3t)(2t + 5r) = 8rt + 20r2 – 6t2 – 15rt = 20r2 – 7rt – 6t2

u. (4r – 3t) – (2t + 5r) = 4r – 3t – 2t – 5r = – r – 5t

w. 3(a – 2)(4a + 1) – 5(2a + 3)(a – 7) = 3(4a 2 + a – 8a – 2) – 5(2a2 – 14a + 3a – 21)

= 12a2 – 21a – 6 – 10a2 + 55a + 105

= 2a2 + 34a + 99

y.  = 6x

aa.  x – y

cc. 

ee.  = 2ab – 3a2

gg. 

1. 3d2 – 4d + $15 = 3($2.50)2 – 4($2.50) + $15

= $18.75 – $10 + $15

= $23.75

3. 7*x*(4y – $8) = 7($3.20)(4 × $1.50 – $8) = $22.4($6 – $8) = – $44.80

5.  = $315.11

7. *L*(1 – *d*1)(1 – *d*2)(1 – *d*3) = $490(1 – 0.125)(1 – 0.15)(1 – 0.05) = $346.22

9. = $2430.38

11. *P*(1 + *i*)*n* = $1280(1 + 0.025)3 = $1378.42

13. = 0.5x + 2.25 – 1.2x + 1.2 = – 0.7x + 3.45

15.  = 16x + 0.5x + 2.3x – 8.5 = 18.8x – 8.5

17.  = 0.96192P + 2.08901P = 3.0509P

19. k(1 + 0.04)2 +  = 1.08160k + 1.84911k = 2.9307k

21. = $1794.22

23. = $1071.77

**Exercise 2.2**

a. a2 × a3 = a5

c. b10 ÷ b6 = b10 – 6 = b4

e. (1 + *i*)4 × (1 + *i*)9 = (1 + *i*)13

g. (*x*4)7 = *x*4x7 = *x*28

i. = t2

k. 

m. = 4(1+*i*)2

o. 

1. = 16.0000

3. 

5. (0.001)– 2 = 1,000,000

7. (1.0085)5(1.0085)3 = 1.00858 = 1.07006

9. 

11.  = - 4.00000

13. 

15. 

17. 

19.  = 1.00908

# Exercise 2.3

a. 2a – 9 = a + 1

2a – a = 1 + 9

a = 10

c. 6(y – 4) = 0

6y – 24 = 0

6y = 24

y = 4

e. -7x – 10 = 11

-7x = 21

x = -3

g. 12 – 3x – 8 = -10x – 10

4 – 3x = -10x – 10

-3x + 10x = -10 – 4

7x = -14

x = -2

i. = 4

x + 2 = 4(x – 1)

x + 2 = 4x – 4

x – 4x = -4 – 2

-3x = -6

x = 2

1. 10a + 10 = 12 + 9a

10a – 9a = 12 – 10

a = 2

3. 0.5 (x – 3) = 20

x – 3 = 40

x = 43

5. y = 192 + 0.04y

y – 0.04y = 192

y = 

7. 12x – 4(2x – 1) =6(x + 1) – 3

12x – 8x + 4 = 6x + 6 – 3

2x = – 1

x = 0.5

9. 8 – 0.5(x + 3) = 0.25(x – 1)

8 – 0.5x – 1.5 = 0.25x – 0.25

0.75x = – 6.75

x = 9

11. 3.1t + 145 = 10 + 7.6t

4.5t = – 135

t = 30

13. = x + 0.8

x + 2 = 5(x + 0.8)

x + 2 = 5x + 4

x – 5x = 4 – 2

-4x = 2

x = -0.5

15. =

- 10.648a = 6 – 4.84

-6.1025a = 1.16

a = -0.19

17. = $35

1.134225x – 0.938967x = $35

0.195258x = $35

x = $179.25

19. 

0.8264463x + 2.662x = $1000

3.488446x = $1000

x = $286.66

21. 

1.626183x + x + 1.343916x = $1000 + $1776.974

3.970099x = $2776.974

x = $699.47

23. x

1.021863x + 1.945318x = $1160.20

2.967181x = $1160.20

x = $391.01

**Exercise 2.4**

1. *I = Prt*

$6.25 = *P*(0.05)0.25

$6.25 = 0.0125*P*

*P* =  = $500.00

3. *S = P*(1 *+ rt*)

$3626 = *P*(1 + 0.004×9)

$3626 = 1.036*P*

*P* =  = $3500.00

5. *N = L*(1 – *d*)

$410.85 = $498(1 – d)

 = 1 – *d*

0.825 = 1 – *d*

*d* = 1 – 0.825 = 0.175

7. *NI* =(*CM* )*X – FC*

$15,000 = *CM*(5000) – $60,000

$15,000 + $60,000 = 5000*CM*

*CM* = = $15.00

9. 

$1468.80 = *L*(1 – 0.20)(1 – 0.15)(1 – 0.10)

$1468.80 = *L*(0.80)(0.85)(0.90)

*L* =  = $2400.00

11. 

$1094.83 = $1000(1 + *i*1)(1 + 0.03)(1 + 0.035)

$1094.83 = $1066.05(1 + *i*1)

 = 1 + *i*1

*i*1 = 1.02700 – 1 = 0.0270

13. 

$6595.20 = *PMT* 

$6595.20 = *PMT* 

*PMT* = $6595.20 = $575.00

15. 

*i*(*PV*) *= PMT*



17. *NI* =(*CM* )*X – FC*

*NI + FC* =(*CM* )*X*



19. *S = P*(1 *+ rt*)

*S = P +Prt*

*S – P = Prt*



21. 





23. 





25. 

$5167.20 = $10,000(1 + i)-15



 = 

1 + *i* =  = 1.0450

*i* = 0.045

**Exercise 2.5**

a. Step 2: Students on 4 buses = 177 less 9 in cars

Let number of students per bus be x.

Step 3: 4 buses x students per bus = students on buses less students in cars

Step 4: 4x = 177 – 9

Step 5: 4x = 168

x = 42

Each bus holds 42 students.

c. Step 2: Weekly earnings = $600 plus 2% commission on sales, Weekly salary = $400

Let s represent weekly sales.

Step 3: Weekly earnings = weekly salary + 2% commission on sales

Step 4: $600 = $400 + 0.02s

Step 5: 0.02s = $600 - $400

0.02s = $200

s = $10,000

The salesperson’s weekly sales were $10,000.

e. Step 2: Money in pocket = $170 after ½ used to pay bill plus an extra $50.

Let c be the amount of her pay cheque.

Step 3: Money in pocket = ½ pay cheque + extra money earned

Step 4: $170 = 0.5c + $50

0.5c = $170 - $50

0.5c = $120

c = $240

Josie’s weekly pay cheque is $240.

1. Step 2: Hits last month = 2655 after the  increase.

Let the number of hits 1 year ago be n.

Step 3: Hits last month = Hits 1 year ago + (Hits 1 year ago)

Step 4: 2655 = n + n

Step 5: 2655 = n

Multiply both sides by .

n = 2655 ×  = 2065

The Web site had 2065 hits in the same month 1 year ago.

3. Step 2: Tag price = $39.55 (including 13% HST). Let the plant's pretax price be P.

Step 3: Tag price = Pre-tax price + HST

Step 4: $39.55 = P + 0.13P

Step 5: $39.55 = 1.13P

P =  = $35.00

The amount of HST is $39.55 – $35.00 = $4.55

5. Step 2: Let the basic price be P. First 20 meals at P.

Next 20 meals at P – $2. Additional meals at P – $3.

Step 3: Total price for 73 meals = $1686

Step 4: 20P + 20(P – $2) + (73 – 40)(P – $3) = $1686

Step 5: 20P + 20P – $40 + 33P – $99 = $1686

73P = $1686 + $99 + $40

P =  = $25.00

The basic price per meal is $25.00.

7. Step 2: Tax rate = 38%; Overtime hourly rate = 1.5($23.50) = $35.25

Cost of canoe = $2750

Let *h* represent the hours of overtime Alicia must work.

Step 3: Gross overtime earnings − Income tax = Cost of the canoe

Step 4: $35.25*h* − 0.38($35.25*h*) = $2750

Step 5: $21.855*h* = $2750

*h* = 125.83 hours

Rounded to the nearest quarter hour, Alicia must work 125¾ hours of overtime to earn enough money to buy the canoe.

9. Step 2: Cost of radio advertising = 0.5(Cost of newspaper advertising)

Cost of TV advertising = 0.6(Cost of radio advertising)

Total advertising budget = $160,000

Let *r* represent the amount allocated to radio advertising

Step 3: Radio advertising + TV advertising + Newspaper advertising = $160,000

Step 4: 

Step 5: 3.6*r* = $160,000

*r* = $44,444.44

Rounded to the nearest dollar, the advertising budget allocations should be:

$44,444 to radio advertising,

0.6($44,444.44) = $26,667 to TV advertising, and

2($44,444.44) = $88,889 to newspaper advertising.

11. Step 2: Overall portfolio’s rate return = 1.1%, equity fund’s rate of return = −3.3%,

bond fund’s rate of return = 7.7%.

Let *e* represent the fraction of the portfolio initially invested in the equity fund.

Step 3: Overall rate of return = Weighted average rate of return

= (Equity fraction)(Equity return) + (Bond fraction)(Bond return)

Step 4: 1.1% = *e*(−3.3%) + (1 − *e*)(7.7%)

Step 5: 1.1% = −3.3%*e* + 7.7% − 7.7%*e*

6.6% = −11.0%*e*

*e* = 0.600

Therefore, 60.0% of Erin’s original portfolio was invested in the equity fund.

13. Step 2: Total options = 100,000

# of options to an executive = 2000 + # of options to a scientist or engineer

# of options to a scientist or engineer = 1.5(# of options to a technician)

There are 3 executives, 8 scientists and engineers, and 14 technicians.

Let *t* represent the number of options to each technician.

Step 3: Total options = Total options to scientists and engineers

+ Total options to technicians + Total options to executives

Step 4: 100,000 = 8(1.5*t*) + 14*t* + 3(2000 + 1.5*t*)

Step 5: = 12*t* + 14*t* + 6000 + 4.5*t*

94,000 = 30.5*t*

*t* = 3082 options

Rounded to the nearest whole numbers, each technician will receive 3082 options,

each scientist and engineer will receive 1.5(3082) = 4623 options,

and each executive will receive 2000 + 4623 = 6623 options.

15. Step 2: Raisins cost $3.75 per kg; peanuts cost $2.89 per kg.

Cost per kg of ingredients in 50 kg of “trail mix” is to be $3.20.

Let *p* represent the weight of peanuts in the mixture.

Step 3: Cost of 50 kg of trail mix = Cost of *p* kg peanuts + Cost of (50 − *p*) kg of raisins

Step 4: 50($3.20) = *p*($2.89) + (50 − *p*)($3.75)

Step 5: $160.00 = $2.89*p* + $187.50 − $3.75*p*

−$27.50 = −$0.86*p*

*p* = 31.98 kg peanuts

(50 – *p*) = 50 – 31.98 = 18.0 kg raisins

32.0 kg of peanuts should be mixed with 18.0 kg of raisins.

17. Step 2: Total investment = $32,760

Sue’s investment = 1.2(Joan’s investment)

Joan’s investment = 1.2(Stella’s investment)

Let L represent Stella’s investment.

Step 3: Sue’s investment + Joan’s investment + Stella’s investment = Total investment

Step 4: Joan’s investment = 1.2L

Sue’s investment = 1.2(1.2L) = 1.44L

1.44L + 1.2L + L = $32,760

Step 5: 3.64L = $32,760

L = 

Stella will invest $9000, Joan will invest 1.2($9000) = $10,800, and

Sue will invest 1.2($10,800) = $12,960

19. Step 2: Time to make X is 20 minutes.

Time to make Y is 30 minutes.

Total time is 47 hours. Total units = 120. Let Y represent the number of units of Y.

Step 3: Total time = (Number of X) × (Time for X) + (Number of Y) × (Time for Y)

Step 4: 47 × 60 = (120 – Y)20 + Y(30)

Step 5: 2820 = 2400 – 20Y + 30Y

420 = 10Y

Y = 42

Forty‑two units of product Y were manufactured.

21. Step 2: Each of 4 children receive 0.5(Wife’s share).

Each of 13 grandchildren receive (Child’s share).

Total distribution = $759,000. Let w represent the wife’s share.

Step 3: Total amount = Wife’s share + 4(Child’s share) + 13(Grandchild’s share)

Step 4: $759,000 = w + 4(0.5w) + 13(0.5w)

Step 5: $759,000 = w + 2w + 

= 

w = $146,903.23

Each child will receive 0.5($146,903.23) = $73,451.62

and each grandchild will receive ($73,451.62) = $24,483.87.

23. Step 2: Hillside charge = 2(Barnett charge) – $1000

Westside charge = Hillside charge + $2000

Total charges = $27,600. Let B represent the Barnett charge.

Step 3: Total charges = Barnett charge + Hillside charge + Westside charge

Step 4: $27,600 = B + 2B – $1000 + 2B – $1000 + $2000

Step 5: $27,600 = 5B

B = $5520

Hence, the Westside charge is 2($5520) – $1000 + $2000 = $12,040

**Review Problems**

1. 4(3a + 2b) – 5a(2 – b) = 12a + 8b – 10a + 5ab

= 2a + 5ab + 8b

3. *a.* 

*b.* 

5. *P*(1 + *i*)*n* +  = $3038.766 + $1466.374 = $4505.14

7. *a.* 

*b.* 

9. *a.* (1.0075)24 = 1.19641

*b.* 

*c.* 

*d.* 

11. *a.* 

1.936545*x* + 1.021014*x* = $831

2.957559*x* = $831

*x* = $280.97

*b.*  3*x*(1.035) + 

3.47782*x* + 0.915142*x* + *x* = $2356.49

*x* = $436.96

13. 

$324.30 = $498(1 – 0.20)(1 – *d*2)(1 – 0.075)

$324.30 = $368.52(1 – *d*2)

 = (1 – *d*2)

*d*2 = 1 – 0.8800 = 0.120 = 12.0%

15. *FV = PV*(1 + *i*1)(1 + *i*2)

 = (1 + *i*1)

*i*1 =  – 1

17. Given: Mint = $0.202/gram; Camomile = $0.158/gram; Blend = $0.179/gram; Total Weight of Blend = 2kg

Let *M* represent grams of Mint tea used in the blend

Total cost of Mint tea + Total cost of Camomile tea = Price for 2kg of the blend

$0.202*M* + $0.158(2000 – *M*) = $0.179 x 2000

$0.202*M* + $316 - $0.158*M* = $358

$0.044*M* = $42

*M* = 954.55 grams

Norman’s tea blend should contain 954.55 grams of Mint tea

19. Given: Grace’s share = 1.2(Kajsa’s share); Mary Anne’s share = (Grace’s share)

Total allocated = $36,000

Let K represent Kajsa’s share.

(Kajsa’s share) + (Grace’s share) + (Mary Anne’s share) = $36,000

K + 1.2K +  = $36,000

2.95 K = $36,000

K = $12,203.39

Kajsa’s should receive $12,203.39. Grace should receive 1.2K = $14,644.07.

Mary Anne should receive($14,644.07) = $9152.54.