

$$\Sigma \text{Int}(1, 403, 6) \\ -97679.90067$$

At the end of 5.5 years he will have saved \$34 149.93 for a down payment. He must finance \$121 850.07. It will take him 403 payments or 201.5 months, which is 65 fewer months, to repay the loan. It will cost him \$49 851.14 less in interest costs for the house.

16. (a)

$$\begin{aligned} N &= 240 \\ I\% &= 10 \\ PV &= 80000 \\ PMT &= -761.33154... \\ FV &= 0 \\ P/Y &= 12 \\ C/Y &= 2 \\ PMT &= \text{END} \text{ BEGIN} \end{aligned}$$

$$\text{bal}(36, 3) \\ 75495.392$$

The monthly payment of the term is \$761.33. The balance owing after the 3 year term is \$75 495.39.

(b)

$$\begin{aligned} N &= 204 \\ I\% &= 22 \\ PV &= 75495.39 \\ PMT &= -1363.8479... \\ FV &= 0 \\ P/Y &= 12 \\ C/Y &= 2 \\ PMT &= \text{END} \text{ BEGIN} \end{aligned}$$

The remaining term is 204 months. The new payment required is \$1363.85.

(c)

$$\frac{1363.85}{761.33} = 1.7914$$

The new payment is 1.7914 times the previous payment. The original payment had to be increased by 79.14% in order to maintain the 20-year amortization.

(d) Interest rates increased very dramatically. When people came to renew their mortgages, the new payment required to maintain the mortgage was beyond what they could afford. Therefore, they had to declare bankruptcy.

17. (a) Payback Option

$$\begin{aligned} N &= 300 \\ I\% &= 7.4 \\ PV &= 116400 \\ PMT &= -844.23132... \\ FV &= 0 \\ P/Y &= 12 \\ C/Y &= 2 \\ PMT &= \text{END} \text{ BEGIN} \end{aligned}$$

$$\begin{aligned} \Sigma \text{Int}(1, 60, 6) \\ -40753.78975 \\ \text{bal}(60, 6) \\ 106499.9103 \\ 106499.91 + 40753.79 \\ 147253.7 \end{aligned}$$

Other option

$$\begin{aligned} N &= 300 \\ I\% &= 7 \\ PV &= 120000 \\ PMT &= -840.4989... \\ FV &= 0 \\ P/Y &= 12 \\ C/Y &= 2 \\ PMT &= \text{END} \text{ BEGIN} \end{aligned}$$

$$\begin{aligned} \Sigma \text{Int}(1, 60, 6) \\ -39683.44851 \\ \text{bal}(60, 6) \\ 109253.5142 \\ 109253.51 + 39683.45 \\ 148936.96 \end{aligned}$$

We find the payments needed to amortize the loan over 25 years and then use these payments to find the balance outstanding and interest paid under each option after 5 years.
Cash back option: payments \$844.23

Interest paid after 5 years: \$40 753.79
Balance after 5 years: \$106 499.91
Total costs after 5 years: \$147 253.70

Select the cash-back option if your mortgage is \$120 000.

(b) competitor's option

18. Answers will vary.

19. The interest rate changed, the amount borrowed, the term (length) of the mortgage.

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1. $t_n = a + (n - 1)d$; $t_n = n^{\text{th}}$ term, a = first term, d = common difference, n = number of terms in the sequence

2. A series is the sum of all of the terms in a sequence. To add the first n terms of an arithmetic series, use

$S_n = \frac{n}{2}[2a + (n - 1)d]$ where n is the position of the term in the series, a is the first term, and d is the common difference between each term in the series.

3. (a)

$$\begin{aligned} S_{17} &= \frac{17}{2}[2(32) + 16(11)] \\ &= \frac{17}{2}(240) \\ &= 2040 \end{aligned}$$

(b)

$$\begin{aligned} S_{23} &= \frac{23}{2}[2(19) + 22(-5)] \\ &= \frac{23}{2}(-72) \\ &= -828 \end{aligned}$$

(c) $t_n = a + (n - 1)d$

$$58 = -68 + (n - 1)(7)$$

$$58 = -68 + 7n - 7$$

$$133 = 7n$$

$$n = 19$$

$$\begin{aligned} S_{19} &= \frac{19}{2}[2(-68) + 18(7)] \\ &= \frac{19}{2}(-10) \\ &= -95 \end{aligned}$$

(d) $t_n = a + (n - 1)d$

$$\frac{9}{2} = \frac{1}{3} + (n - 1)\left(\frac{1}{6}\right)$$

$$\frac{9}{2} = \frac{1}{3} + \frac{1}{6}n - \frac{1}{6}$$

$$27 = 2 + n - 1$$

$$n = 26$$

$$\begin{aligned}
 S_{26} &= \frac{26}{2} \left[2\left(\frac{1}{3}\right) + 25\left(\frac{1}{6}\right) \right] \\
 &= 13 \left(\frac{4}{6} + \frac{25}{6} \right) \\
 &= 13 \left(\frac{29}{6} \right) \\
 &= \frac{377}{6}
 \end{aligned}$$

4. $t_7 = 41$, $41 = a + 6d$; $t_{18} = 96$, $96 = a + 17d$

$$\begin{aligned}
 96 &= a + 17d \quad \textcircled{1} \\
 41 &= a + 6d \quad \textcircled{2} \\
 \textcircled{1} - \textcircled{2} \quad 55 &= 11d \\
 d &= 5
 \end{aligned}$$

Substitute $d = 5$ into $\textcircled{2}$.

$$\begin{aligned}
 41 &= a + 6(5) \\
 a &= 11 \\
 S_{28} &= \frac{28}{2} [2(11) + 27(5)] \\
 &= 14(22 + 135) \\
 &= 2198
 \end{aligned}$$

5. $t_{11} = -12$
 $t_n = a + (n-1)d$
 $-12 = a + 10d \quad \textcircled{1}$
 $S_{15} = -315$

$$\begin{aligned}
 S_n &= \frac{n}{2} [2a + (n-1)d] \\
 -315 &= \frac{15}{2} (2a + 14d) \\
 -630 &= 30a + 210d \quad \textcircled{2} \\
 \text{Solve the system.} \\
 30a + 210d &= -630 \quad \textcircled{2} \\
 a + 10d &= -12 \quad \textcircled{1} \\
 30 \times \textcircled{1} \quad 30a + 300d &= -360 \quad \textcircled{3} \\
 \underline{30a + 210d} &= \underline{-630} \quad \textcircled{2} \\
 \textcircled{3} - \textcircled{2} \quad 90d &= 270 \\
 d &= 3
 \end{aligned}$$

Substitute $d = 3$ into $\textcircled{1}$.

$$\begin{aligned}
 a + 10(3) &= -12 \\
 a &= -42 \\
 t_n &= -42 + (n-1)(3) \\
 t_1 &= -42, t_2 = -39, t_3 = -36, t_4 = -33
 \end{aligned}$$

6. The sum of her deposits can be represented by the arithmetic series $5 + 8 + 11 + 14 + 17 + 20 + 23 + 26 + 29 + 32 + 35 + 38 + 41 + 44 + 47 + 50 + 53 + 56 + 59 + 62$.

$$\begin{aligned}
 S_n &= \frac{n}{2} [2a + (n-1)d] \\
 S_{20} &= \frac{20}{2} [2(5) + 19(3)] \\
 &= 10(10 + 57) \\
 &= 670
 \end{aligned}$$

Her deposit box will contain \$1017 (\$670 + \$347).

7. The general term of a geometric sequence is $t_n = ar^{n-1}$ where a represents the first term, r represents the common ratio, n represents the number of terms, and t_n represents the n^{th} term.

8. $S_n = a + ar + ar^2 + ar^3 + \dots + ar^{n-1}$

The formula used to add the first n terms of a geometric series

is $S_n = \frac{a(r^n - 1)}{r - 1}$ where n is the position of the term in the sequence, a is the first term, and r is the common ratio between each term.

9. $S_n = \frac{a(r^n - 1)}{r - 1}$

(a) $a = 4$, $r = 5$, $n = 9$

$$\begin{aligned}
 S_8 &= \frac{4(5^9 - 1)}{5 - 1} \\
 &= 5^9 - 1 \\
 &= 1\,953\,124
 \end{aligned}$$

(b) $a = 19$, $r = -2$, $n = 13$

$$\begin{aligned}
 S_{13} &= \frac{19((-2)^{13} - 1)}{-2 - 1} \\
 &= \frac{19(-8193)}{-3} \\
 &= 51\,889
 \end{aligned}$$

(c) $a = 192\,000$, $r = -\frac{1}{2}$, $t_n = 1500$

$$\begin{aligned}
 1500 &= 192\,000 \left(-\frac{1}{2} \right)^{n-1} \\
 \frac{1}{128} &= \left(-\frac{1}{2} \right)^{n-1} \\
 7 &= n - 1 \\
 n &= 8 \\
 S_n &= \frac{a(r^n - 1)}{r - 1} \\
 S_8 &= \frac{192\,000 \left(\left(-\frac{1}{2} \right)^8 - 1 \right)}{-\frac{1}{2} - 1} \\
 &= \frac{192\,000 \left(-\frac{255}{256} \right)}{-\frac{3}{2}} \\
 &= 192\,000 \left(-\frac{255}{256} \right) \left(-\frac{2}{3} \right) \\
 &= 192\,000 \left(\frac{85}{128} \right) \\
 &= 127\,500
 \end{aligned}$$

(d) $a = 300, r = 1.1, n = 12$

$$S_{12} = \frac{300(1.1^{12} - 1)}{1.1 - 1}$$

$$= \frac{300(2.138\ 428)}{0.1}$$

$$= 6415.2851$$

$$= 6415.29$$

10. (a) $a = 22\ 800, r = 1.025, n = 10$

$$t_n = ar^{n-1}$$

$$t_{10} = 22\ 800(1.025)^9 = \$28\ 474.08$$

Her 10th cheque will be for \$28 474.08.

(b) After 10 years, she will have received her 11th payment.

We want to find S_{11} .

$$S_{11} = \frac{22\ 800(1.025^{11} - 1)}{1.025 - 1}$$

$$= \frac{22\ 800(0.312\ 086\ 66)}{0.025}$$

$$= \$284\ 623.03$$

After 10 years, she would have received a total of \$284 623.03.

11. (a) The sum of the prizes represents a geometric series with $a = 10, r = 3$, and $S_n < 1\ 000\ 000$. Solve for n .

$$1\ 000\ 000 = \frac{10(3^n - 1)}{3 - 1}$$

$$2\ 000\ 000 = 10(3^n - 1)$$

$$200\ 000 = 3^n - 1$$

$$199\ 999 = 3^n$$

$$\log(199\ 999) = n \log 3$$

$$n = \frac{\log(199\ 999)}{\log 3}$$

$$= 11.1$$

Therefore, 11 tickets can be drawn without giving away more than \$1 000 000.

(b) Find the sum of the 11 prize tickets drawn.

$$S_{11} = \frac{10(3^{11} - 1)}{3 - 1}$$

$$= \frac{10(177\ 146)}{2}$$

$$= 885\ 730$$

\$885 730 in prize money is awarded. Therefore, \$114 270 (\$1 000 000 – \$885 730) is left after all the prizes are awarded.

12. An annuity is an investment plan in which fixed amounts of money are deposited or paid at regular intervals over a specified period of time. An ordinary annuity is an annuity in which periodic payments are made at the end of each time interval, whereas an annuity due is an annuity in which periodic payments are made at the beginning of each time interval.

13. The amortization period of a loan or mortgage is the length of time that it would take for the debt to be paid in full if all blended payments (payments used to pay both the interest and the principal) are made punctually. An amortization table is used to show the amount of the regular blended payment, how much of the payment is interest, how much is used to reduce the principal, and the outstanding balance after each payment. A spreadsheet is useful in creating amortization tables and for analyzing the effects of changing the parameters of a loan problem.

14. (a) $i = \frac{0.06}{12} = 0.005$

The monthly rate of interest is 0.005 or 0.5%.

(b) Ewen's savings plan is an example of an ordinary simple annuity because his payments are made at the end of each time interval and his periodic payments correspond to the interest conversion period (both calculated monthly).

(c)

Period	Balance	Interest at 6%/a	Payment	New Balance
1	\$0.00	\$0.00	\$110.00	\$110.00
2	\$110.00	\$0.55	\$110.00	\$220.55
3	\$220.55	\$1.10	\$110.00	\$331.65
4	\$331.65	\$1.66	\$110.00	\$443.31
5	\$443.31	\$2.22	\$110.00	\$555.53
6	\$555.53	\$2.78	\$110.00	\$668.31
7	\$668.31	\$3.34	\$110.00	\$781.65
8	\$781.65	\$3.91	\$110.00	\$895.55
9	\$895.55	\$4.48	\$110.00	\$1010.03
10	\$1010.03	\$5.05	\$110.00	\$1125.08
11	\$1125.08	\$5.63	\$110.00	\$1240.71
12	\$1240.71	\$6.20	\$110.00	\$1356.91
13	\$1356.91	\$6.78	\$110.00	\$1473.70
14	\$1473.70	\$7.37	\$110.00	\$1591.06
15	\$1591.06	\$7.96	\$110.00	\$1709.02
16	\$1709.02	\$8.55	\$110.00	\$1827.57
17	\$1827.57	\$9.14	\$110.00	\$1946.70
18	\$1946.70	\$9.73	\$110.00	\$2066.44
19	\$2066.44	\$10.33	\$110.00	\$2186.77
20	\$2186.77	\$10.93	\$110.00	\$2307.70
21	\$2307.70	\$11.54	\$110.00	\$2429.24
22	\$2429.24	\$12.15	\$110.00	\$2551.39
23	\$2551.39	\$12.76	\$110.00	\$2674.14
24	\$2674.14	\$13.37	\$110.00	\$2797.52

At the end of two years, the value of his savings is \$2797.52.

(d) He earned \$157.52 in interest.

(e) The new balance after 2 years is \$3962.78.

15. (a) $i = \frac{0.18}{12} = 0.015$

Payment Number	Payment	Interest Paid	Principal Paid	Outstanding Balance
0	-----	-----	-----	\$2400
1	\$130	\$36.00	\$94.00	\$2306
2	\$130	\$34.59	\$95.41	\$2210.59
3	\$130	\$33.16	\$96.84	\$2113.75
4	\$130	\$31.71	\$98.29	\$2015.46
5	\$130	\$30.23	\$99.77	\$1915.69
6	\$130	\$28.74	\$101.26	\$1814.43
7	\$130	\$27.22	\$102.78	\$1711.65
8	\$130	\$25.67	\$104.33	\$1607.32

She will owe \$1607.32 after 8 months.

(b)

	A	B	C	D	E
1	Pay. #	Pay.	Interest Paid	Princ. Paid	Out. Bal.
2	0				\$2400
3	=A2+1	\$130	=E2*0.015	=B3-C3	=E2-D3

(c) It will take 22 months to repay the complete loan. The final payment will be \$101.27.

(d) Total Cost = $21 \times 130 + 101.27 = \$2831.27$

(e)

Payment Number	Payment	Interest Paid	Principal Paid	Outstanding Balance
0				\$2400.00
1	\$153.13	\$36.00	\$117.13	\$2282.87
2	\$153.13	\$34.24	\$118.89	\$2163.98
3	\$153.13	\$32.46	\$120.67	\$2043.31
4	\$153.13	\$30.65	\$122.48	\$1920.83
5	\$153.13	\$28.81	\$124.32	\$1796.51
6	\$153.13	\$26.95	\$126.18	\$1670.33
7	\$153.13	\$25.05	\$128.08	\$1542.26
8	\$153.13	\$23.13	\$130.00	\$1412.26
9	\$153.13	\$21.18	\$131.95	\$1280.32
10	\$153.13	\$19.20	\$133.93	\$1146.39
11	\$153.13	\$17.20	\$135.93	\$1010.46
12	\$153.13	\$15.16	\$137.97	\$872.48
13	\$153.13	\$13.09	\$140.04	\$732.44
14	\$153.13	\$10.99	\$142.14	\$590.30
15	\$153.13	\$8.85	\$144.28	\$446.02
16	\$153.13	\$6.69	\$146.44	\$299.58
17	\$153.13	\$4.49	\$148.64	\$150.95
18	\$153.13	\$2.26	\$150.87	\$0.08

The monthly payment amount is \$153.13.

16.

Payment Number	Payment	Interest Paid	Principal Paid	Outstanding Balance
0				\$2440.00
1	\$158.02	\$40.75	\$117.27	\$2322.73
2	\$158.02	\$38.79	\$119.23	\$2203.50
3	\$158.02	\$36.80	\$121.22	\$2082.28
4	\$158.02	\$34.77	\$123.25	\$1959.03
5	\$158.02	\$32.72	\$125.30	\$1833.73
6	\$158.02	\$30.62	\$127.40	\$1706.33
7	\$158.02	\$28.50	\$129.52	\$1576.80
8	\$158.02	\$26.33	\$131.69	\$1445.12
9	\$158.02	\$24.13	\$133.89	\$1311.23
10	\$158.02	\$21.90	\$136.12	\$1175.11
11	\$158.02	\$19.62	\$138.40	\$1036.71
12	\$158.02	\$17.31	\$140.71	\$896.01
13	\$158.02	\$14.96	\$143.06	\$752.95
14	\$158.02	\$12.57	\$145.45	\$607.50
15	\$158.02	\$10.15	\$147.87	\$459.63
16	\$158.02	\$7.68	\$150.34	\$309.28
17	\$158.02	\$5.17	\$152.85	\$156.43
18	\$158.02	\$2.61	\$155.41	\$1.02

The annual interest rate charged is 20%/a compounded monthly.

17.

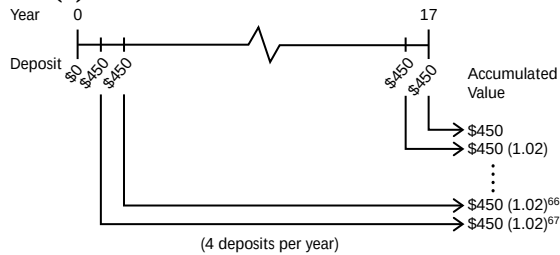
Per.	Balance	Interest at 7%/a	Payment	New Balance
1	\$0.00	\$0.00	\$567.10	\$567.10
2	\$567.10	\$9.92	\$567.10	\$1144.12
3	\$1144.12	\$20.02	\$567.10	\$1731.25
4	\$1731.25	\$30.30	\$567.10	\$2328.64
5	\$2328.64	\$40.75	\$567.10	\$2936.49
6	\$2936.49	\$51.39	\$567.10	\$3554.98
7	\$3554.98	\$62.21	\$567.10	\$4184.30
8	\$4184.30	\$73.23	\$567.10	\$4824.62
9	\$4824.62	\$84.43	\$567.10	\$5476.15
10	\$5476.15	\$95.83	\$567.10	\$6139.08
11	\$6139.08	\$107.43	\$567.10	\$6813.62
12	\$6813.62	\$119.24	\$567.10	\$7499.96

She would have to deposit \$567.10 every three months.

18. R represents the amount of the periodic payment, i represents the interest rate for each pay period, and n represents the number of periods.

$$19. S_n = \frac{a(r^n - 1)}{r - 1} \text{ and } FV = R \times \frac{(1+i)^n - 1}{i}.$$

20. (a)



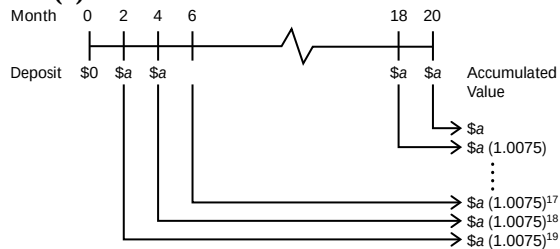
(b) $S_{68} = 450 + 450(1.02) + 450(1.02)^2 + \dots + 450(1.02)^{66} + 450(1.02)^{67}$

(c) $S_{68} = FV = \frac{450(1.02^{68} - 1)}{1.02 - 1} = \$63\,995.64$

On her 17th birthday there will be \$63 995.64 in the savings plan.

Total interest earned = \$63 995.64 - 450(68) = \$33 395.64

21. (a)



(b) $S_{20} = 3200$
 $= R + R(1.0075) + R(1.0075)^2 + \dots + R(1.0075)^{18} + R(1.0075)^{19}$

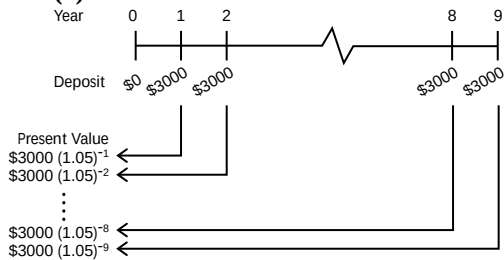
(c) $S_{20} = 3200$
 $3200 = \frac{R(1.0075^{20} - 1)}{1.0075 - 1}$

$3200(0.0075) = R(0.161\,184\,14)$

$R = \frac{24}{0.161\,184\,14}$

$R = \$148.90$

22. (a)



(b) $S_n = 30\,000$
 $= 475 + 475(1.005) + 475(1.005)^2 + \dots + 475(1.005)^{n-2} + 475(1.005)^{n-1}$

(c)

$$30\,000 = \frac{475(1.005^n - 1)}{1.005 - 1}$$

$$150 = 475(1.005^n - 1)$$

$$1.315\,789\,47 = 1.005^n$$

$$\log(1.315\,789\,47) = n \log(1.005)$$

$$n = \frac{\log(1.315\,789\,47)}{\log(1.005)}$$

$$n = 55.02$$

It will take them about 55 months to save for the down payment.

(d) $n = 48$, $S_{48} = 30\,000$, $r = 1.005$, and $a = R$

$$30\,000 = \frac{R(1.005^{48} - 1)}{1.005 - 1}$$

$$150 = R(1.005^{48} - 1)$$

$$150 = R(0.270\,489\,16)$$

$$R = 554.55$$

The monthly deposit needed over 4 years is \$554.55.

23. The present value is the sum of all the equivalent present values of each of the payments at the beginning of the term, whereas the future value is the sum of all the future values of each payment at the end of the term.

24. Use $S_n = \frac{a(r^n - 1)}{r - 1}$ with $a = R(1 + i)^{-n}$ and $r = (1 + i)$

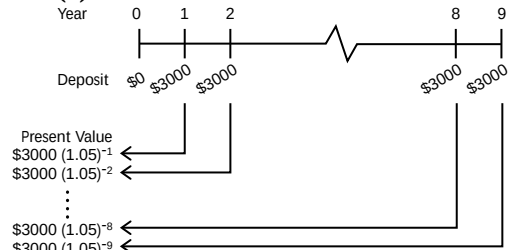
$$S_n = \frac{R(1 + i)^{-n}[(1 + i)^n - 1]}{1 + i - 1} \quad \text{Distribute } (1 + i)^{-n}.$$

$$= \frac{R[(1 + i)^{-n+n} - (1 + i)^{-n}]}{i}$$

$$= \frac{R[(1 + i)^0 - (1 + i)^{-n}]}{i}$$

$$= R \times \frac{1 - (1 + i)^{-n}}{i}$$

25. (a) i.



ii. $S_9 = 3000(1.05)^{-9} + 3000(1.05)^{-8} + \dots + 3000(1.05)^{-2} + 3000(1.05)^{-1}$

iii.

$$S_9 = \frac{a(r^9 - 1)}{r - 1}$$

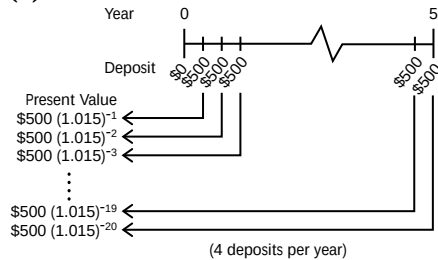
$$= 3000(1.05)^{-9} \frac{(1.05^9 - 1)}{1.05 - 1}$$

$$\cong 3000(0.644\ 608\ 9)(11.026\ 564\ 3)$$

$$\cong 21\ 323.47$$

The present value of the annuity is \$21 323.47.

(b) i.



ii. $S_{20} = 500(1.015)^{-20} + 500(1.015)^{-19} + \dots + 500(1.015)^{-2} + 500(1.015)^{-1}$

iii.

$$S_{20} = \frac{a(r^{20} - 1)}{r - 1}$$

$$= 500(1.015)^{-20} \frac{(1.015^{20} - 1)}{1.015 - 1}$$

$$= 500(0.742\ 470\ 42)(23.123\ 667\ 1)$$

$$= \$8584.32$$

The present value of the annuity is \$8584.32.

26. (a) We need to find the present value of an ordinary annuity where $R = 75$, $i = 0.0175$, and $n = 18$.

$$PV = R \times \frac{1 - (1 + i)^{-n}}{i}$$

$$= 75 \times \frac{(1 - 1.0175^{-18})}{0.0175}$$

$$= \$1149.51$$

The selling price of the Windsurfer is \$1499.51 (\$1149.51 + \$350).

(b) Financing cost = Total costs – Selling price

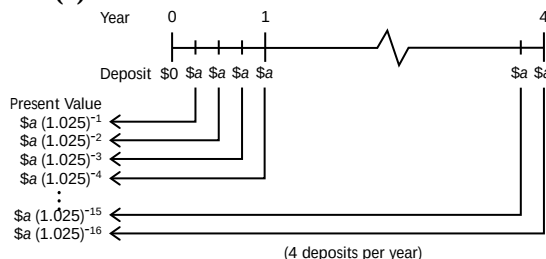
$$= 75 \times 18 + 350 - 1499.51$$

$$= 1700 - 1499.51$$

$$= \$200.49$$

The financing cost is \$200.49.

27. (a)



(b) $S_{16} = 9200$

$$S_{16} = R(1.025)^{-16} + R(1.025)^{-15} + \dots + R(1.025)^{-2} + R(1.025)^{-1}$$

Part 1: Financial Applications of Sequences and Series

(c)

$$S_{16} = \frac{a(r^{16} - 1)}{r - 1}$$

$$9200 = R(1.025)^{-16} \frac{(1.025^{16} - 1)}{1.025 - 1}$$

$$9200 = R(13.055\ 002\ 66)$$

$$R = 704.71$$

Mr. Ryder's quarterly payment would be \$704.71.

28. In a simple annuity the payment interval corresponds to the interest conversion period whereas in a general annuity, the payment interval and the interest conversion period do not correspond.

29. (a) Let i represent the annual rate.

$$1 + i = \left(1 + \frac{0.15}{4}\right)^4$$

$$i = (1.0375)^4 - 1$$

$$i = 0.158\ 650$$

The nominal rate is 0.158 650 or about 15.865%.

(b) Let i represent the equivalent monthly rate.

$$(1 + i)^{12} = (1.0375)^4$$

$$1 + i = \sqrt[12]{(1.0375)^4}$$

$$1 + i = \sqrt[3]{1.0375}$$

$$i = 0.012\ 346\ 926$$

The equivalent nominal rate is $12 \times 0.012\ 346\ 926$ or 14.816%.

(c) Let i represent the equivalent weekly rate.

$$(1 + i)^{52} = (1.0375)^4$$

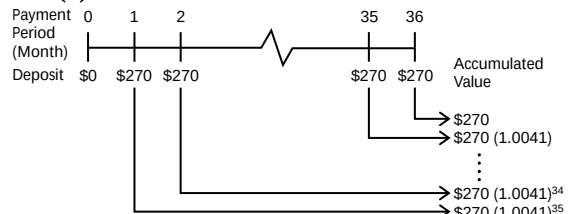
$$1 + i = \sqrt[52]{(1.0375)^4}$$

$$1 + i = \sqrt[13]{1.0375}$$

$$i = 0.002\ 835\ 857\ 5$$

The equivalent nominal rate is $52 \times 0.002\ 835\ 857\ 5$ or 14.746%.

30. (a)



(b) We find the monthly rate, i , equivalent to 5%/a.

$$(1 + i)^{12} = 1.05$$

$$1 + i = \sqrt[12]{1.05}$$

$$i = 0.004\ 074$$

$$S_{36} = 270 + 270(1.0041) + 270(1.0041)^2 + \dots + 270(1.0041)^{34} + 270(1.0041)^{35}$$

$$(c) S_{36} = \frac{270(1.0041^{36} - 1)}{1.0041 - 1} = \$10\ 450.94$$

She will have \$10 450.94 saved for the jeep.

(d) She borrows \$4349.06 (\$14 800 – \$10 450.94). Find the monthly rate equivalent to 8%/a compounded semiannually.

$$(1 + i)^{12} = (1.04)^2$$

$$1 + i = \sqrt[12]{(1.04)^2}$$

$$i = \sqrt[12]{1.04} - 1$$

$$i = 0.006\,558\,197$$

Find the monthly payments that yield a present value of \$4349.06.

$$PV = R \times \frac{(1+i)^n - 1}{i}$$

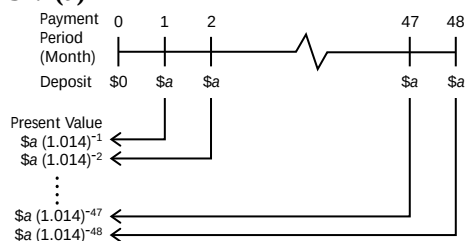
$$4349.06 = R \times \frac{1.006\,558\,197^{24} - 1}{0.006\,558\,197}$$

$$4349.06 = R(25.900\,192)$$

$$R = \$167.92$$

Her monthly payment will be \$167.92.

31. (a)



(b) Find the monthly interest rate, i , equivalent to 18%/a compounded annually.

$$(1 + i)^{12} = 1.18$$

$$i = \sqrt[12]{1.18} - 1$$

$$i = 0.013\,888\,43$$

$$PV = 8700$$

$$PV = R(1.013\,888\,43)^{-48} + R(1.013\,888\,43)^{-47} + \dots + R(1.013\,888\,43)^{-2} + R(1.013\,888\,43)^{-1}$$

(c)

$$S_{48} = \frac{a(r^n - 1)}{r - 1}$$

$$8700 = R(1.013\,888\,43)^{-48} \frac{(1.013\,888\,43^{48} - 1)}{1.013\,888\,43 - 1}$$

$$8700 = R(34.864\,35)$$

$$R = \$249.54$$

Yolanda's monthly payment is \$249.54.

Verify using technology.

N=48
I%=18
PV=8700
PMT=-249.53855...
FV=0
P/Y=12
C/Y=1
PMT: BEGIN

32. (a) $n = 26 \times 3 = 78$

$$(1 + i)^{26} = (1.0075)^{12}$$

$$1 + i = \sqrt[26]{1.0075^{12}}$$

$$i = 0.003\,454\,576$$

$$PV = R \times \frac{1 - (1+i)^{-n}}{i}$$

$$17\,300 = R \times \frac{1 - (1.003\,454\,576)^{-78}}{0.003\,454\,576}$$

$$17\,300 = R(68.272\,072\,98)$$

$$R = \$253.40$$

The bi-weekly payment required is \$253.40.

(b) The loan would be repaid in 64 bi-weekly payments instead of 73 bi-weekly payments. The Coopers could have the loan repaid 18 weeks or 9 payments sooner.

(c) If the interest rate is 9%/a compounded annually, the bi-weekly payment required is \$252.12.

33. (a) (i)

N=300
I%=7.6
PV=98000
PMT=-723.08904...
FV=0
P/Y=12
C/Y=2
PMT: BEGIN

The payment is \$723.09.

(ii)

N=240
I%=7.6
PV=98000
PMT=-788.42629...
FV=0
P/Y=12
C/Y=2
PMT: BEGIN

The payment is \$788.43.

(b) Interest for 25 year – Interest for 20 year

$$= \$118\,926.71 - \$91\,222.31$$

$$= \$27\,704.40$$

They will save \$27 704.40 in interest by choosing the shorter term.

(c) Suggest the shorter term.

34. (a)

N=96
I%=8.4
PV=43800
PMT=-624.91561...
FV=0
P/Y=12
C/Y=2
PMT: BEGIN

The monthly payment is \$624.90.

(b)

Payment Number	Payment	Int. Paid 0.688%/a	Princ. Paid	Balance
0				\$43 800.00
1	\$624.90	\$301.34	\$323.56	\$43 476.44
2	\$624.90	\$299.12	\$325.78	\$43 150.66
...	...	...	...	...
95	\$624.90	\$8.51	\$616.39	\$620.73
96	\$624.90	\$4.27	\$620.63	\$0.10

(c) She will pay $(\$624.90)(96) - \$43\,800 = \$16\,190.40$ in interest.

35. (a)

```

N=1157.969684
I%=8.8
PV=115800
PMT=-225
FV=0
P/Y=52
C/Y=2
PMT:BEGIN

```

It will take about 1158 weeks or 22.27 years to repay the mortgage.

(b) The interest charge is

$(\$225)(1157.969\ 684) - \$115\ 800 = \$144\ 743.18$ and the total cost of the house is $\$282\ 543.18$ ($\$144\ 743.18 + \$137\ 800$).

(c) Interest with \$250 payments:

$(\$250)(881.553\ 437) - 115\ 800 = \$104\ 588.41$

She would save $\$40\ 154.77$ ($\$144\ 743.18 - \$104\ 588.41$) in interest by increasing the weekly payments to \$250.

36. (a)

```

N=300
I%=8.6
PV=182000
PMT=-1459.3671...
FV=0
P/Y=12
C/Y=2
PMT:BEGIN

```

The monthly payment needed is \$1459.37.

(b) Outstanding balance at the end of year 1 is \$179 781.71, end of year 2 is \$177 368.55, year 3 is \$174 743.39, year 4 is \$171 887.61, and year 5 is \$168 780.96.

(c) \$209.10 of the 20th payment is applied to the principal.

\$415.00 of the 120th payment is applied to the principal.

(d) At the end of 5 years the balance outstanding is

\$168 780.96. They renew for a \$150 780.96 mortgage. The new monthly payment is \$1195.25.

(e) The Wongs still owe \$139 573.91.

Chapter 2 Review Test, page 203

1. (a) $a = -11$, $d = 8$, $t_n = 125$

$$t_n = a + (n - 1)d$$

$$125 = -11 + (n - 1)8$$

$$125 = -11 + 8n - 8$$

$$144 = 8n$$

$$n = 18$$

$$S_n = \frac{n}{2}[2a + (n - 1)d]$$

$$S_{18} = \frac{18}{2}[2(-11) + 17(8)]$$

$$= 9(114)$$

$$= 1026$$

(b) $a = 6$, $d = -3$, $t_n = 39\ 366$

$$t_n = ar^{n-1}$$

$$39\ 366 = 6(-3)^{n-1}$$

$$6561 = (-3)^{n-1}$$

$$(-3)^8 = (-3)^{n-1}$$

$$8 = n - 1$$

$$n = 9$$

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$S_9 = \frac{6[(-3)^9 - 1]}{-3 - 1}$$

$$= \frac{6(-19\ 684)}{-4}$$

$$= 29\ 526$$

2. (a) Use an arithmetic series with $a = 262$, $d = 18$, and $S_n = 15\ 690$. Solve for n .

$$S_n = \frac{n}{2}[2a + (n - 1)d]$$

$$15\ 690 = \frac{n}{2}[2(262) + (n - 1)18]$$

$$15\ 690 = \frac{n}{2}(524 + 18n - 18)$$

$$15\ 690 = \frac{n}{2}(506 + 18n)$$

$$15\ 690 = 253n + 9n^2$$

$$9n^2 + 253n - 15\ 690 = 0$$

Use the quadratic formula.

$$n = \frac{-253 \pm \sqrt{253^2 - 4(9)(-15\ 690)}}{2(9)}$$

$$n = \frac{-253 \pm 793}{18}$$

$$n = \frac{-253 + 793}{18} \text{ or } n = \frac{-253 - 793}{18}$$

$$n = 30 \text{ or } n = -58.\bar{1}$$

There are 30 rows of seats in the arena.

(b) Find the number of seats in the 31st, 32nd, and 33rd rows.

$$t_{31} = 262 + 30(18) = 802$$

$$t_{32} = 262 + 31(18) = 820$$

$$t_{33} = 262 + 30(18) = 838$$

Adding three rows increases the capacity by 2460 seats.

$$\text{Increase in capacity}(\%) = \frac{2460}{15\ 690} \times 100\% = 15.7\%$$

3. The sum of the prizes awarded can be represented by the geometric series $20 + 50 + 125 + \dots$ with $a = 20$ and $r = 2.5$. Find S_{14} , the cost of 14 prizes.

$$S_{14} = \frac{a(r^{14} - 1)}{r - 1}$$

$$= \frac{20(2.5^{14} - 1)}{2.5 - 1}$$

$$= \frac{20(372\ 528.0298)}{1.5}$$

$$= \$4\ 967\ 040.40$$

Therefore, the lottery has sufficient funds for 14 prizes.