

16. (a)

```
N=72
I%=7.2
PV=0
PMT=-832
FV=74549.05116
P/Y=12
C/Y=1
PMT:END BEGIN
```

FV = \$74 549.05

(b)

```
N=60
I%=7.2
PV=0
PMT=-832
FV=59523.35678
P/Y=12
C/Y=1
PMT:END BEGIN
```

FV = \$59 523.36

(c) If they stop after 5 years, we can simply take the future value from (16b) and calculate the compounded interest for one year at 7.2%/a compounded yearly. The future value is therefore $59\,523.36 \times 1.072 = \$63\,809.04$.

(d) $n = 78$ since the term is 6.5×12

```
N=78
I%=7.2
PV=0
PMT=-832
FV=81805.34383
P/Y=12
C/Y=1
PMT:END BEGIN
```

FV = \$81 805.34

(e) The sooner they begin to save, the sooner their savings can accumulate compound interest. The longer time period they save, the more they can accumulate.

17. They should include the following key feature: Start saving now (do not wait). Make the deposits as large and as often as possible. Shop around for the greatest interest rates available. Save for as long as you can to accumulate a larger deposit. The compounding period is not as important, but look for the shortest compounding period if the interest rates are the same.

18. (a)

```
N=24
I%=20.99854691
PV=2390
PMT=-122.81
FV=0
P/Y=12
C/Y=1
PMT:END BEGIN
```

Annual rate of interest = 21%.

(b) Interest cost = Total cost – Amount borrowed
 $= \$122.81 \times 24 - \$2390$
 $= \$557.44$

19. 12%/a compounded monthly will produce 1%/month compounded monthly. This means that for the second and third months, interest will be earned on the 1% interest earned in the previous month. After 3 months, the initial deposit will grow by $(1.01)(1.01)(1.01)$, 1.030 301 times its value or 3.030 301% over 3 months while 12%/a compounded quarterly earns 3% over 3 months. Therefore, 12%/a

compounded monthly is a greater rate than 12%/a compounded quarterly.

20. (a) By trial and error, annual interest charge is 20.04% compounded monthly.

(b)

$$\left(\frac{0.2004}{12} + 1 \right)^{12} - 1 = 1.21987 - 1$$

$$= 21.987\%$$

$$\approx 21.99\% \text{ compounded annually}$$

21. (a) No you should not. One possible example to illustrate that the payment does not double is shown below.

```
N=48
I%=10
PV=10000
PMT=-253.62583...
FV=0
P/Y=12
C/Y=1
PMT:END BEGIN
```

```
N=48
I%=20
PV=10000
PMT=-304.30362...
FV=0
P/Y=12
C/Y=1
PMT:END BEGIN
```

(b) Yes you should. One possible example to illustrate that the payment also doubles, when the amount borrowed doubles, is shown below. It is like taking two loans of equal value, therefore, the payment is twice as much.

```
N=48
I%=10
PV=8000
PMT=-202.9006...
FV=0
P/Y=12
C/Y=1
PMT:END BEGIN
```

```
N=48
I%=10
PV=16000
PMT=-405.801335
FV=0
P/Y=12
C/Y=1
PMT:END BEGIN
```

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(a)

```
N=18.00
I%=21.00
PV=2650.00
PMT=-172.90
FV=0.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

Alysa's monthly payments are \$172.90.

(b) She will pay $\$172.90(18) - \$2650 = \$462.18$ in interest for the loan.

(c) She still owes \$1280.33 on the truck after her 10th payment.

(d) \$147.90 of this 10th payment goes towards the principal.

```
ΣInt(1,18,6)
-462.18
bal(10,6)
1280.33
ΣPrn(10,10,6)
-147.90
```

(e) Store the interest paid, principal paid, and outstanding balance in Y1, Y2, and Y3.

```
Plot1 Plot2 Plot3
Y1=ΣInt(X,X,6)
Y2=ΣPrn(X,X,6)
Y3=bal(X,6)
Y4=
Y5=
Y6=
Y7=
```

The amortization of the loan is shown below.

X	Y ₁	Y ₂
1.00	-46.38	-126.5
2.00	-44.16	-128.7
3.00	-41.91	-131.0
4.00	-39.62	-133.3
5.00	-37.28	-135.6
6.00	-34.91	-138.0
7.00	-32.50	-140.4

X=7

X	Y ₂	Y ₃
1.00	-126.5	2523.5
2.00	-128.7	2384.7
3.00	-131.0	2263.7
4.00	-133.3	2150.5
5.00	-135.6	1994.8
6.00	-138.0	1856.8
7.00	-140.4	1744.3

Y₃=1716.453897

X	Y ₁	Y ₂
8.00	-30.04	-142.9
9.00	-27.54	-145.4
10.00	-24.99	-147.9
11.00	-22.41	-150.5
12.00	-19.77	-153.1
13.00	-17.09	-155.8
14.00	-14.37	-158.5

Y₂=-158.533307

X	Y ₂	Y ₃
8.00	-142.9	1573.6
9.00	-145.4	1428.2
10.00	-147.9	1280.3
11.00	-150.5	1129.8
12.00	-153.1	976.71
13.00	-155.8	820.90
14.00	-158.5	662.37

Y₃=662.366319

X	Y ₁	Y ₂
12.00	-19.77	-153.1
13.00	-17.09	-155.8
14.00	-14.37	-158.5
15.00	-11.59	-161.3
16.00	-8.77	-164.1
17.00	-5.90	-167.0
18.00	-2.97	-169.9

Y₂=-169.925356

X	Y ₂	Y ₃
12.00	-153.1	976.71
13.00	-155.8	820.90
14.00	-158.5	662.37
15.00	-161.3	501.06
16.00	-164.1	336.93
17.00	-167.0	169.93
18.00	-169.9	0

Y₃=-6E-6

Practise, Apply, Solve 2.12 page 191

1. (a) $(1+i)^{12} = (1.05)^2$

$$\sqrt[12]{(1+i)^{12}} = \sqrt[12]{1.05^2}$$

$$1+i = 1.05^{\frac{2}{12}}$$

$$i = 1.05^{\frac{1}{6}} - 1$$

$$i = 0.008\ 164\ 85$$

(b) $(1+i)^{12} = (1.035)^2$

$$\sqrt[12]{(1+i)^{12}} = \sqrt[12]{1.035^2}$$

$$1+i = 1.035^{\frac{2}{12}}$$

$$i = 1.035^{\frac{1}{6}} - 1$$

$$i = 0.005\ 750\ 04$$

(c) $(1+i)^{24} = (1.04)^2$

$$\sqrt[24]{(1+i)^{24}} = \sqrt[24]{1.04^2}$$

$$1+i = 1.04^{\frac{2}{24}}$$

$$i = 1.04^{\frac{1}{12}} - 1$$

$$i = 0.003\ 273\ 74$$

(d) $(1+i)^{52} = (1.06)^2$

$$\sqrt[52]{(1+i)^{52}} = \sqrt[52]{1.06^2}$$

$$1+i = 1.06^{\frac{2}{52}}$$

$$i = 1.06^{\frac{1}{26}} - 1$$

$$i = 0.002\ 243\ 63$$

(e) $(1+i)^{365} = (1.055)^2$

$$\sqrt[365]{(1+i)^{365}} = \sqrt[365]{1.055^2}$$

$$1+i = 1.055^{\frac{2}{365}}$$

$$i = 0.000\ 293\ 42$$

(f) $(1+i)^{52} = (1.055)^2$

$$\sqrt[52]{(1+i)^{52}} = \sqrt[52]{1.055^2}$$

$$1+i = 1.055^{\frac{2}{52}}$$

$$i = 1.055^{\frac{1}{26}} - 1$$

$$i = 0.002\ 061\ 38$$

2. (a) $(1+i)^{12} = (1.035)^2$

$$i = 1.035^{\frac{2}{12}} - 1$$

$$i = 0.005\ 750\ 04 \text{ or } i = 0.575\ 004\%/a$$

(b) $(1+i)^{12} = (1.0425)^2$

$$i = 1.0425^{\frac{2}{12}} - 1$$

$$i = 0.006\ 961\ 06 \text{ or } i = 0.696\ 106\%/a$$

(c) $(1+i)^{12} = (1.0495)^2$

$$i = 1.0495^{\frac{2}{12}} - 1$$

$$i = 0.008\ 084\ 82 \text{ or } i = 0.808\ 482\%/a$$

(d) $(1+i)^{12} = (1.06)^2$

$$i = 1.06^{\frac{2}{12}} - 1$$

$$i = 0.009\ 758\ 79 \text{ or } i = 0.975\ 879\%/a$$

3. Answers will vary.

4. (a) \$646.18/month is equivalent to \$646.18 × 12 or \$7754.16 per year, while \$161.55/week is equivalent to \$161.55 × 52 or \$8400 per year.

(b) If \$646.18/month is equal to \$7754.16 per year, then the weekly equivalent payment is \$7754.16 ÷ 52 or \$149.12.

(c) By making weekly payments of \$149.12, the loan is repaid in 1040.5 weeks. By making monthly payments of \$646.18, the loan is repaid in 20 years or 1040 weeks.

Changing the payment frequency has little or no effect on the time needed to repay the loan.

N=1040.496526
I%=8.44
PV=75800
PMT=-149.12
FV=0
P/Y=52
C/Y=2
PMT:BEGIN

(d) The payment amount has a much greater effect on the repayment of a loan.

5. Answers will vary. *Example:* Interest on Canadian mortgages can be compounded at most semiannually.

However, payments are generally made monthly, weekly, or biweekly, which does not coincide with the interest paid.

6. (a) (i)

N=300
I%=8.8
PV=80000
PMT=-651.90235...
FV=0
P/Y=12
C/Y=2
PMT:BEGIN

Monthly mortgage payment = \$651.90