PEARSON NEW INTERNATIONAL EDITION

Student Solutions Manual for Thinking Mathematically Blitzer Fifth Edition

ALWAYS LEARNING

PEARSON

Pearson New International Edition

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for Thinking Mathematically
Blitzer
Fifth Edition

PEARSON

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Table of Contents

Problem Solving and Critical Thinking

Check Points 1

1. Counterexamples will vary. Example: $40 \times 40 = 1600$

2. a. Add 6 each time.
3 + 6 = 9
9 + 6 = 15
15 + 6 = 21
21 + 6 = 27
27 + 6 = 33
3, 9, 15, 21, 27, 33

b. Multiply by 5 each time.
2 × 5 = 10
10 × 5 = 50
50 × 5 = 250
250 × 5 = 1250
2, 10, 50, 250, 1250

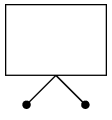
c. Cycle multiplying by 2, 3, 4.
3 × 2 = 6
6 × 3 = 18
18 × 4 = 72
72 × 2 = 144
144 × 3 = 432
432 × 4 = 1728
1728 × 2 = 3456
6, 18, 72, 144, 432, 1728, 3456

d. Cycle adding 8, adding 8, subtracting 14.
1 + 8 = 9
9 + 8 = 17
17 – 14 = 3
3 + 8 = 11
11 + 8 = 19
19 – 14 = 5
5 + 8 = 13
13 + 8 = 21
21 – 14 = 7
9, 17, 3, 11, 19, 5, 13, 21, 7

3. a. Starting with the third number, each number is the sum of the previous two numbers, 29 + 47 = 76

b. Starting with the second number, each number one less than twice the previous number, $2(129) - 1 = 257$

4. The shapes alternate between rectangle and triangle.
The number of little legs cycles from 1 to 2 to 3 and then back to 1.
Therefore the next figure will be a rectangle with 2 little legs.



5. a. Conjecture based on results: The original number is doubled.

Select a number.	4	10	0	3
Multiply the number by 4.	$4 \times 4 = 16$	$10 \times 4 = 40$	$0 \times 4 = 0$	$3 \times 4 = 12$
Add 6 to the product.	$16 + 6 = 22$	$40 + 6 = 46$	$0 + 6 = 6$	$12 + 6 = 18$
Divide this sum by 2.	$22 \div 2 = 11$	$46 \div 2 = 23$	$6 \div 2 = 3$	$18 \div 2 = 9$
Subtract 3 from the quotient.	$11 - 3 = 8$	$23 - 3 = 20$	$3 - 3 = 0$	$9 - 3 = 6$
Summary of results:	4 → 8	10 → 20	0 → 0	3 → 6

b. Select a number: n
Multiply the number by 4: $4n$
Add 6 to the product: $4n + 6$
Divide this sum by 2: $\frac{4n+6}{2} = \frac{4n}{2} + \frac{6}{2} = 2n + 3$
Subtract 3 from the quotient: $2n + 3 - 3 = 2n$

Problem Solving and Critical Thinking

Check Points 2

1. a. The digit to the right of the billions digit is greater than 5. Thus, add 1 to the digit to be rounded and replace all the digits to the right with zeroes. 6,751,593,103 rounded to the nearest billion is 7,000,000,000.

b. The digit to the right of the hundred millions is 5. Thus, add 1 to the digit to be rounded and replace all the digits to the right with zeroes. 6,751,593,103 rounded to the nearest hundred million is 6,800,000,000.

c. The digit to the right of the ten thousands digit is less than 5. Thus, replace all the digits to the right with zeroes. 6,751,593,103 rounded to the nearest hundred thousand is 6,751,590,000.

2. a. The digit to the right of the tenths digit is less than 5. Thus, 3.141593 rounded to the nearest tenth is 3.1.

b. The digit to the right of the ten-thousandths digit is greater than 5. Thus, 3.141593 rounded to the nearest ten-thousandth is 3.1416.

3. a.

$$\begin{aligned}&\$2.40+\$1.25+\$4.60+\$4.40+\$1.40+\$1.85+2.95\\ &\approx \$2+\$1+\$5+\$4+\$1+\$2+3\\ &\approx \$18\end{aligned}$$

b. The bill of $21.85 is not reasonable. It is too high.

4. a. Round $52 per hour to $50 per hour and assume 40 hours per week.

$$\frac{40 \text{ hours}}{\text{week}} \times \frac{\$50}{\text{hour}} = \frac{\$2000}{\text{week}}$$

The architect's salary is $\approx \$2000$ per week.

b. Round 52 weeks per year to 50 weeks per year.

$$\frac{\$2000}{\text{week}} \times \frac{50 \text{ weeks}}{\text{year}} = \frac{\$100,000}{\text{year}}$$

The architect's salary is $\approx \$100,000$ per year.

5. a. $0.32 \times 21,728,978$

b. $0.3 \times 22,000,000 = 6,600,000$ defined old age in this way.

6. a. The yearly increase in life expectancy can be approximated by dividing the change in life expectancy by the change in time from 1960 to 2005. $\frac{80.4-73.1}{2005-1960} = \frac{7.3}{45} \approx 0.16$ yr for each subsequent birth year.

b.

$$\begin{aligned}\overbrace{73.1}^{\text{life expectancy in 1950}} + \overbrace{0.16}^{\text{yearly increase}} \left(\overbrace{2050-1960}^{\text{number of years from 1960 to 2050}}\right) &= 73.1+0.16(90)\\ &= 73.1+14.4\\ &= 87.5 \text{ yr}\end{aligned}$$

7. a. about 66% of seniors

b. The percentage of seniors who used marijuana decreased at the slowest rate can be found by identifying the portion of the graph with the smallest downward slope. This occurs between 2000 and 2005.

c. Approximately 57% of seniors used alcohol in 1990.

8. a. The yearly increase in tuition and fees can be approximated by dividing the change in tuition and fees by the change in time from 2000 to 2008. $\frac{\$23,712-\$15,518}{2008-2000} = \frac{\$8194}{8} \approx \$1024$

b. $T = \overbrace{15,518}^{\text{Cost in 2000}} + \overbrace{1024}^{\text{yearly increase}} x$

c. 2012 is 12 years after 2000. Thus,

$$\begin{aligned}T &= 15,518+1024x\\ &= 15,518+1024(12)\\ &= \$27,806\end{aligned}$$

Exercise Set 2

1. a. 55,444,600

b. 55,445,000

c. 55,440,000

d. 55,400,000

e. 55,000,000

f. 60,000,000

11.
$$\begin{array}{r} {\scriptstyle 1\ 1\ \ \ \ } \\ 14632_{\text{seven}} \\ +5604_{\text{seven}} \\ \hline 23536_{\text{seven}} \end{array}$$
$$6+6=12=(1\times 7^1)+(5\times 1)=15_{\text{seven}}$$
$$1+4+5=10=(1\times 7^1)+(3\times 1)=13_{\text{seven}}$$

13.
$$\begin{array}{r} {\scriptstyle 2\ 6\ \ \ \ } \\ 3\not{2}_{\text{four}} \\ -13_{\text{four}} \\ \hline 13_{\text{four}} \end{array}$$

15.
$$\begin{array}{r} {\scriptstyle 1\ 8\ \ \ \ } \\ 2\not{3}_{\text{five}} \\ -14_{\text{five}} \\ \hline 4_{\text{five}} \end{array}$$

17.
$$\begin{array}{r} {\scriptstyle 6\ 13\ \ \ \ } \\ 47\not{5}_{\text{eight}} \\ -267_{\text{eight}} \\ \hline 206_{\text{eight}} \end{array}$$

19.
$$\begin{array}{r} {\scriptstyle 4\ 12\ \ 10\ \ } \\ 5\not{6}\not{3}_{\text{seven}} \\ -164_{\text{seven}} \\ \hline 366_{\text{seven}} \end{array}$$

21.
$$\begin{array}{r} {\scriptstyle 0\ 1\ 2\ \ \ } \\ 1\not{0}\not{0}1_{\text{two}} \\ -111_{\text{two}} \\ \hline 10_{\text{two}} \end{array}$$

23.
$$\begin{array}{r} {\scriptstyle 1\ 2\ 3\ \ \ } \\ 12\not{0}\not{0}_{\text{three}} \\ -1012_{\text{three}} \\ \hline 111_{\text{three}} \end{array}$$

25.
$$\begin{array}{r} {\scriptstyle 3\ \ \ \ } \\ 25_{\text{six}} \\ \times 4_{\text{six}} \\ \hline 152_{\text{six}} \end{array}$$
$$\begin{aligned} (2_{\text{six}}\times 4_{\text{six}})+3_{\text{six}} &= 8_{\text{ten}}+3_{\text{six}} \\ &= 12_{\text{six}}+3_{\text{six}} \\ &= 15_{\text{six}} \end{aligned}$$

27.
$$\begin{array}{r} 11_{\text{two}} \\ \times\ 1_{\text{two}} \\ \hline 11_{\text{two}} \end{array}$$

29.
$$\begin{array}{r} {\scriptstyle 3\ 2\ \ \ } \\ 543_{\text{seven}} \\ \times\ \ 5_{\text{seven}} \\ \hline 4011_{\text{seven}} \end{array}$$
$$3\times 5=15=(2\times 7^1)+(1\times 1)=21_{\text{seven}}$$
$$(4\times 5)+2=22=(3\times 7^1)+(1\times 1)=31_{\text{seven}}$$
$$(5\times 5)+3=28=(4\times 7^1)+(0\times 1)=40_{\text{seven}}$$

31.
$$\begin{array}{r} {\scriptstyle 1\ 1\ \ \ } \\ 623_{\text{eight}} \\ \times\ \ 4_{\text{eight}} \\ \hline 3114_{\text{eight}} \end{array}$$
$$\begin{aligned} (3_{\text{eight}}\times 4_{\text{eight}}) &= 12_{\text{ten}} \\ &= (1\times 8^1)+(4\times 1) \\ &= 14_{\text{eight}} \\ (2_{\text{eight}}\times 4_{\text{eight}})+1_{\text{eight}} &= 8_{\text{ten}}+1_{\text{ten}} \\ &= 9_{\text{ten}} \\ &= (1\times 8^1)+(1\times 1) \\ &= 11_{\text{eight}} \\ (6_{\text{eight}}\times 4_{\text{eight}})+1_{\text{eight}} &= 24_{\text{ten}}+1_{\text{ten}} \\ &= 25_{\text{ten}} \\ &= (3\times 8^1)+(1\times 1) \\ &= 31_{\text{eight}} \end{aligned}$$

33.
$$\begin{array}{r} 21_{\text{four}} \\ \times 12_{\text{four}} \\ \hline 102 \\ 210 \\ \hline 312_{\text{four}} \end{array}$$
$$\begin{aligned} 21_{\text{four}}\times 2_{\text{four}} &= 9_{\text{ten}}\times 2_{\text{ten}} \\ &= 18 \\ &= (1\times 4^2)+(0\times 4)+(2\times 1) \\ &= 102_{\text{four}} \\ 21_{\text{four}}\times 1_{\text{four}} &= 21_{\text{four}} \end{aligned}$$

81. $f(20) = 0.4(20)^2 - 36(20) + 1000$
$= 0.4(400) - 720 + 1000$
$= 160 - 720 + 1000$
$= -560 + 1000 = 440$
Twenty-year-old drivers have 440 accidents per 50 million miles driven.
This is represented on the graph by point (20,440).

83. The graph reaches its lowest point at $x = 45$.
$f(45) = 0.4(45)^2 - 36(45) + 1000$
$= 0.4(2025) - 1620 + 1000$
$= 810 - 1620 + 1000$
$= -810 + 1000$
$= 190$
Drivers at age 45 have 190 accidents per 50 million miles driven. This is the least number of accidents for any driver between ages 16 and 74.

91. makes sense

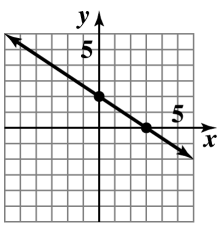
93. makes sense

95. $f(-1) + g(-1) = 1 + (-3) = -2$

97. $f\left(g(-1)\right) = f(-3) = 1$

Check Points 2

1. Find the x-intercept by setting $y = 0$
$2x + 3(0) = 6$
$2x = 6$
$x = 3$; resulting point (3, 0)
Find the y-intercept by setting $x = 0$
$2(0) + 3y = 6$
$3y = 6$
$y = 2$; resulting point (0, 2)
Find a checkpoint by substituting any value.
$2(1) + 3y = 6$
$2 + 3y = 6$
$3y = 4$
$y = \frac{4}{3}$; resulting point $\left(1, \frac{4}{3}\right)$



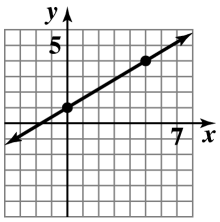
2. a. $m = \frac{-2-4}{-4-(-3)} = \frac{-6}{-1} = 6$

b. $m = \frac{5-(-2)}{-1-4} = \frac{7}{-5} = -\frac{7}{5}$

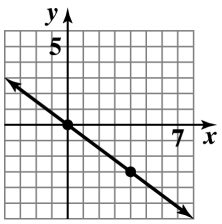
3. Step 1. Plot the y-intercept of (0, 1)

Step 2. Obtain a second point using the slope m.
$m = \frac{3}{5} = \frac{\text{Rise}}{\text{Run}}$
Starting from the y-intercept move up 3 units and move 5 units to the right. This puts the second point at (3, 6).

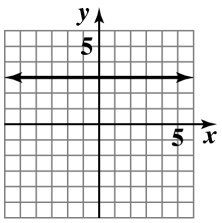
Step 3. Draw the line through the two points.



4. Solve for y.
$3x + 4y = 0$
$4y = -3x + 0$
$\frac{4y}{4} = \frac{-3x}{4} + \frac{0}{4}$
$y = \frac{-3}{4}x + 0$
$m = \frac{-3}{4}$ and the y-intercept is (0, 0)



5. Draw horizontal line that intersects the y-axis at 3.



f. No. The fact that all four criteria are satisfied in a particular case does not mean that the method used always satisfies all four criteria.

29. makes sense

31. does not make sense; Explanations will vary. Sample explanation: The majority criterion could be violated. For instance, suppose candidate A is the first choice of 51% of voters and is approved by 60% of voters, yet candidate B is the first choice of 49% of voters and is approved by 70% of voters.

Check Points 3

1. a. $\text{Standard divisor} = \dfrac{\text{total population}}{\text{number of allocated items}} = \dfrac{10,000}{200} = 50$

b. $\text{Standard quota for state A} = \dfrac{\text{population of state A}}{\text{standard divisor}} = \dfrac{1112}{50} = 22.24$

$\text{Standard quota for state B} = \dfrac{\text{population of state B}}{\text{standard divisor}} = \dfrac{1118}{50} = 22.36$

$\text{Standard quota for state C} = \dfrac{\text{population of state C}}{\text{standard divisor}} = \dfrac{1320}{50} = 26.4$

$\text{Standard quota for state D} = \dfrac{\text{population of state D}}{\text{standard divisor}} = \dfrac{1515}{50} = 30.3$

$\text{Standard quota for state E} = \dfrac{\text{population of state E}}{\text{standard divisor}} = \dfrac{4935}{50} = 98.7$

Table 27 Population of Amador by State

State	A	B	C	D	E	Total
Population (in thousands)	1112	1118	1320	1515	4935	10,000
Standard quota	22.24	22.36	26.4	30.3	98.7	200

2.

State	Population (in thousands)	Standard Quota	Lower Quota	Fractional Part	Surplus	Final Apportionment
A	1112	22.24	22	0.24		22
B	1118	22.36	22	0.36		22
C	1320	26.4	26	0.4 (next largest)	1	27
D	1515	30.3	30	0.3		30
E	4935	98.7	98	0.7 (largest)	1	99
Total	10,000	200	198			200