

## Facts and Reminders

There are a number of unusual and interesting number patterns which are introduced in this unit.

### Palindromes

*Palindromes* are numbers (or words such as *dad* and *mom*) which have the same digits whether read forward or backwards. Below are some examples of palindromes.

121                  333                  1331                  2234322                  76567

Palindromes often yield unusual patterns when they are added or multiplied.

$$\begin{array}{r} 121 \\ \times 11 \\ \hline 1331 \end{array}$$

$$\begin{array}{r} 151 \\ \times 11 \\ \hline 1661 \end{array}$$

$$\begin{array}{r} 1221 \\ \times 11 \\ \hline 13431 \end{array}$$

### Palindrome Puzzle

1. Start with any number.
2. Reverse the digits and add the reversed digits to the original number.

**Example:**                  1279

3. Reverse the digits and add again.

$$\begin{array}{r} 1279 \\ + 9721 \\ \hline 11000 \\ + 00011 \\ \hline 11011 \end{array}$$

4. Continue the process until another palindrome is formed.

### Multiplication Patterns

Don't use a calculator or pencil and paper to solve these problems. Try to find the pattern from the answers shown.

$$\begin{array}{r} 40 \\ \times 40 \\ \hline 1600 \end{array}$$

$$\begin{array}{r} 41 \\ \times 39 \\ \hline 1599 \end{array}$$

$$\begin{array}{r} 42 \\ \times 38 \\ \hline 1596 \end{array}$$

$$\begin{array}{r} 43 \\ \times 37 \\ \hline 1591 \end{array}$$

$$\begin{array}{r} 44 \\ \times 36 \\ \hline 1584 \end{array}$$

$$\begin{array}{r} 45 \\ \times 35 \\ \hline 1575 \end{array}$$

Each answer can be computed by following these steps:

1. Multiply 40 x 40.
2. Subtract the square of the counting number or digit after the 40.

**Example:**

$$\begin{array}{r} 42 \\ \times 38 \\ \hline 1596 \end{array}$$

40 x 40 = 1600  
42 is 2 more than 40  
2 x 2 = 4  
1600 - 4 = 1596

# Oddball Patterns

## Palindromes

*Palindromes* are digits that are in the same order whether they are read backwards or forwards. Below are some examples of palindromes.

131

111

34543

889988

32123

**Directions:** Study the Facts and Reminders page for this unit. Use a calculator and pencil and paper to solve these problems. (Some problems will be too large for a calculator.) Look for the pattern in the answers.

1. 
$$\begin{array}{r} 121 \\ \times 11 \\ \hline \end{array}$$

2. 
$$\begin{array}{r} 151 \\ \times 11 \\ \hline \end{array}$$

3. 
$$\begin{array}{r} 242 \\ \times 11 \\ \hline \end{array}$$

4. 
$$\begin{array}{r} 171 \\ \times 11 \\ \hline \end{array}$$

5. 
$$\begin{array}{r} 181 \\ \times 11 \\ \hline \end{array}$$

6. 
$$\begin{array}{r} 232 \\ \times 11 \\ \hline \end{array}$$

7. 
$$\begin{array}{r} 545 \\ \times 11 \\ \hline \end{array}$$

8. 
$$\begin{array}{r} 353 \\ \times 11 \\ \hline \end{array}$$

9. 
$$\begin{array}{r} 2442 \\ \times 11 \\ \hline \end{array}$$

10. 
$$\begin{array}{r} 24442 \\ \times \quad 11 \\ \hline \end{array}$$

11. 
$$\begin{array}{r} 123321 \\ \times \quad 11 \\ \hline \end{array}$$

12. 
$$\begin{array}{r} 123321 \\ \times \quad 111 \\ \hline \end{array}$$

13. 
$$\begin{array}{r} 141 \\ \times 11 \\ \hline \end{array}$$

14. 
$$\begin{array}{r} 141 \\ \times 111 \\ \hline \end{array}$$

15. 
$$\begin{array}{r} 124421 \\ \times \quad 11 \\ \hline \end{array}$$

16. 
$$\begin{array}{r} 171 \\ \times 111 \\ \hline \end{array}$$

17. 
$$\begin{array}{r} 12344321 \\ \times \quad 11 \\ \hline \end{array}$$

18. 
$$\begin{array}{r} 4444 \\ \times 11 \\ \hline \end{array}$$

19. 
$$\begin{array}{r} 2222 \\ \times 11 \\ \hline \end{array}$$

20. 
$$\begin{array}{r} 123454321 \\ \times \quad 11 \\ \hline \end{array}$$

### Extension

In the space below, create some multiplication problems using palindromes which also yield palindromes in the answers.

1.

2.

3.

4.

Which digits seem to work especially well? \_\_\_\_\_

Try to make palindromes with 3- or 4-digit multipliers.

# Oddball Patterns

## Unusual Number Patterns

### Directions

- Study the Facts and Reminders page for this unit.
- Compute the problems shown here.
- Look for the pattern.
- Try doing some of them in your mind.
- Check your answers with pencil and paper. (The calculator doesn't have enough room for all of the answers.)

$$\begin{aligned}1 \times 1 &= \underline{\hspace{2cm}} \\11 \times 11 &= \underline{\hspace{2cm}} \\111 \times 111 &= \underline{\hspace{2cm}} \\1111 \times 1111 &= \underline{\hspace{2cm}} \\11111 \times 11111 &= \underline{\hspace{2cm}} \\111111 \times 111111 &= \underline{\hspace{2cm}} \\1111111 \times 1111111 &= \underline{\hspace{2cm}} \\11111111 \times 11111111 &= \underline{\hspace{2cm}} \\111111111 \times 111111111 &= \underline{\hspace{2cm}}\end{aligned}$$

1. Describe the pattern. \_\_\_\_\_  
\_\_\_\_\_
2. Explain why you think it works the way it does. \_\_\_\_\_  
\_\_\_\_\_
3. How could you predict the product of 111,111,111,111 and 111,111,111,111?  
\_\_\_\_\_

**Directions:** Use your calculator and pencil and paper to solve these problems. The calculator won't have room to do the longer problems. Look for the pattern.

4. 
$$\begin{array}{r}12,345,679 \\ \times 9 \\ \hline\end{array}$$

5. 
$$\begin{array}{r}12,345,679 \\ \times 18 \\ \hline\end{array}$$

6. 
$$\begin{array}{r}12,345,679 \\ \times 27 \\ \hline\end{array}$$

7. 
$$\begin{array}{r}12,345,679 \\ \times 36 \\ \hline\end{array}$$

8. 
$$\begin{array}{r}12,345,679 \\ \times 45 \\ \hline\end{array}$$

9. 
$$\begin{array}{r}12,345,679 \\ \times 54 \\ \hline\end{array}$$

10. 
$$\begin{array}{r}12,345,679 \\ \times 63 \\ \hline\end{array}$$

11. 
$$\begin{array}{r}12,345,679 \\ \times 72 \\ \hline\end{array}$$

12. 
$$\begin{array}{r}12,345,679 \\ \times 81 \\ \hline\end{array}$$

13. Do the same problems but include the 8 in the multiplicand (upper number). For example, multiply 123,456,789 x 9, etc. Describe what changed in the answer pattern.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Answer Key

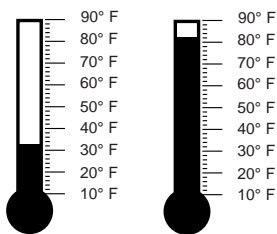
8. (26, 29, 44, 48, 65, 66, 73, 100, 118, 124)  
Median: 65.5  
Extension: 1. R: (22) M: (4, 8, 9) 2. R: (28) M: (14, 18, 22) 3. R: (36) M: (27) 4. R: (64) M: (20, 45) 5. R: (14) M: (12) 6. R: (43) M: (-) 7. R: (34) M: (12) 8. R: (98) M: (-)

## Page 126

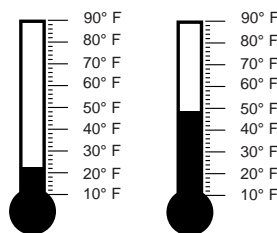
- Total: 77 Divided by: 7 Mean: 11
- Total: 112 Divided by: 7 Mean: 16
- Total: 136 Divided by: 8 Mean: 17
- Total: 208 Divided by: 8 Mean: 26
- Total: 298 Divided by: 8 Mean: 37
- Total: 659 Divided by: 10 Mean: 66
- Total: 1056 Divided by: 10 Mean: 106
- Total: 218 Divided by: 10 Mean: 22
- Total: 333 Divided by: 14 Mean: 24
- Total: 5100 Divided by: 9 Mean: 567

Extension: Answers will vary.

## Page 128



1. 32° F      2. 84° F

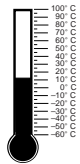


3. 22° F      4. 48° F

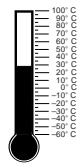
- 32° F
- 212° F
- 57° F
- 75° F
- 20° F
- 22° F
- 112° F
- 180° F
- 142° F
- 62° F
- 82° F

## Page 129

1. 12° C      2. 29° C

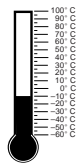


cool

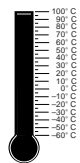


warm

3. -10° C      4. 97° C

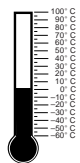


below freezing

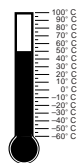


very hot (near boiling)

5. 2° C      6. 50° C

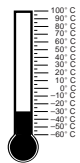


cold

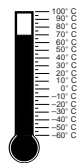


very hot

7. -30° C      8. 70° C



below freezing



very hot

- 100° C—steaming tea kettle  
100° C—hot soup  
5° C—cold sandwich  
20° C—chips  
5° C—milk  
37° C—your tongue  
0° C—snow  
250° C—burning wood  
18° C—furnace turns on  
205° C—baked potato just out of the oven

## Page 130

Answers will vary.

## Page 132

- 1331
- 1661
- 2662
- 1881
- 1991
- 2552
- 5995
- 3883
- 26862
- 268862
- 1356531
- 13688631
- 1551
- 15651
- 1368631
- 18981
- 135787531
- 48884
- 24442
- 1357997531

Extension: Answers will vary.

## Page 133

- 1  
121  
12321  
1234321  
123454321  
12345654321  
1234567654321  
123456787654321  
12345678987654321

- 1.–3. Answers may vary.  
4. 111,111,111  
5. 222,222,222  
6. 333,333,333  
7. 444,444,444  
8. 555,555,555  
9. 666,666,666  
10. 777,777,777  
11. 888,888,888  
12. 999,999,999  
13. A zero is added before the last digit

## Page 134

- 1600
- 1599
- 1596
- 1591
- 1584
- 1575
- 1564
- 1551
- 3600
- 3599
- 3596
- 3591
- 3584
- 3575
- 3564
- 3551
- 33033
- 799997
- 215512
- 66666
- 21.–24. Answers will vary.