

17. [Exploring Number]

Skill 17.1 Comparing whole numbers.

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Compare the size of the digits in the same place, one at a time.
- Work from left to right across each number.

Q. Which number is the largest?

- A) 24,706
B) 24,670
C) 24,760

A. C

Tens of thousands and thousands:

All numbers have the same digit in the tens of thousands place (2), and the same digit in the thousands place (4).

Hundreds:

In the hundreds place 7 is greater than 6. So A and C are greater than B.

Tens:

In the tens place 6 is greater than 0. So 24,760 is greater than 24,706.

> means "is greater than"

< means "is less than"

a) $45,804 > 45,480$
True or false?

$8 > 4$

⇒

true

compare the hundreds place

b) $3207 < 3072$
True or false?

⇒

c) $60,198 > 61,980$
True or false?

⇒

d) $9137 < 9317$
True or false?

⇒

e) $52,620 > 52,260$
True or false?

⇒

f) $7548 > 7584$
True or false?

⇒

g) Which number is the largest?

- A) 1805
B) 1850
C) 1800

$5 > 0$

⇒

B

compare the digits in the tens place

h) Which number is the largest?

- A) 30,931
B) 30,391
C) 30,913

⇒

i) Which number is the largest?

- A) 19,054
B) 19,504
C) 19,450

⇒

j) Which number is the largest?

- A) 2380
B) 2083
C) 2308

⇒

k) Which number is the largest?

- A) 62,075
B) 62,570
C) 62,750

⇒

l) Which number is the largest?

- A) 47,091
B) 47,190
C) 47,019

⇒

Skill 17.2 Understanding and finding the place value of a digit in a number (1).

MMBlue 1 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Compare the position of the digit to the position of the decimal point.
Hint: There is a decimal point which is not written, at the end of any whole number.

Place value	tens of thousands	thousands	hundreds	tens	units	tenths	hundredths	thousandths
Value	30,000	6000	100	50	8	$\frac{2}{10}$	$\frac{4}{100}$	$\frac{7}{1000}$
	3	6	1	5	8	2	4	7

↑
Decimal point

Q. What is the value of the underlined digit in the number 36,158.247? **A.** 30,000 Consider the position of the digit 3 to that of the decimal point. 3 is five places to the left so it is in the tens of thousands place. The 3 represents 3 tens of thousands or 30,000

- | | |
|--|---|
| <p>a) In the number 14,058 which digit is in the tens place? 5</p> | <p>b) In the number 9023 which digit is in the units place? </p> |
| <p>c) In the number 5836 which digit is in the hundreds place? </p> | <p>d) In the number 24,108 which digit is in the thousands place? </p> |
| <p>e) In the number 16.253 which digit is in the units place? </p> | <p>f) In the number 0.017 which digit is in the hundredths place? </p> |
| <p>g) In the number 45.809 which digit is in the tenths place? </p> | <p>h) In the number 0.0874 which digit is in the thousandths place? </p> |
| <p>i) What is the value of the underlined digit in the number 2<u>5</u>9?

5 tens ⇒ 50</p> | <p>j) What is the value of the underlined digit in the number 3<u>2</u>70?

⇒ </p> |
| <p>k) What is the value of the underlined digit in the number 16,<u>0</u>92?

⇒ </p> | <p>l) What is the value of the underlined digit in the number 86,<u>9</u>25?

⇒ </p> |

Skill 17.2 Understanding and finding the place value of a digit in a number (2).

- m) What is the value of the underlined digit in the number $\underline{5}124$?

..... \Rightarrow

- n) What is the value of the underlined digit in the number $73,06\underline{1}$?

..... \Rightarrow

- o) What is the value of the underlined digit in the number $\underline{2}9,603$?

..... \Rightarrow

- p) What is the value of the underlined digit in the number $8\underline{7}14$?

..... \Rightarrow

- q) What is the value of the underlined digit in the number $35.04\underline{3}$?

$4 \text{ hundredths} = \frac{4}{100} =$

- r) What is the value of the underlined digit in the number $5.08\underline{2}$?

$2 \text{ thousandths} =$

- s) What is the value of the underlined digit in the number $0.9\underline{8}$?

..... $=$

- t) What is the value of the underlined digit in the number $1.07\underline{6}$?

..... $=$

- u) In which number does the digit 4 have greater value? A) 4.65
B) 30.4

A) value 4

B) value 0.4 $4 > 0.4 \Rightarrow$

- v) In which number does the digit 6 have greater value? A) 20,406
B) 1063

A)

B) \Rightarrow

- w) In which number does the digit 1 have greater value? A) 3.15
B) 1.98

A)

B) \Rightarrow

- x) In which number does the digit 9 have greater value? A) 4907
B) 10,892

A)

B) \Rightarrow

- y) In which number does the digit 3 have greater value? A) 8.931
B) 1.375

A)

B) \Rightarrow

- z) In which number does the digit 5 have greater value? A) 0.652
B) 0.526

A)

B) \Rightarrow

Skill 17.3 Writing word numbers in standard form.

- Write the digits in order.
- Write a comma between the thousands place and the hundreds place, and between the millions place and the hundreds of thousands place.
- Write a zero in any place that is left empty.

Hints: The comma is now commonly omitted in 4-digit whole numbers.

Q. Express in numerals:
fifty thousand, six hundred nine

A. 50,609

Tens of Th.	Th.	H	T	U
5	0	6	0	9

First write 50 for the words "fifty thousand"; then write a comma. Write the digit 6 for the hundreds, then write the digit 0, because there are no tens. Finally write the digit 9 for the units.

a) Express in numerals:
two hundred fifteen

215

b) Express in numerals:
four thousand one hundred fifty

c) Express in numerals:
six thousand eighty-two

d) Express in numerals:
eight thousand one hundred seventeen

e) Express in numerals:
nine hundred two

f) Express in numerals:
three thousand four hundred

g) Express in numerals:
two hundred ninety-eight

h) Express in numerals:
seven thousand three hundred nine

i) Express in numerals:
five hundred thirty

j) Express in numerals:
twelve thousand, six hundred

k) Express in numerals:
seven hundred fourteen

l) Express in numerals:
fourteen thousand, sixty-three

m) Express in numerals:
sixty thousand, five hundred forty

n) Express in numerals:
thirty-one thousand, seven

o) Express in numerals:
four hundred three thousand, two hundred

p) Express in numerals:
eight hundred thousand, fifty

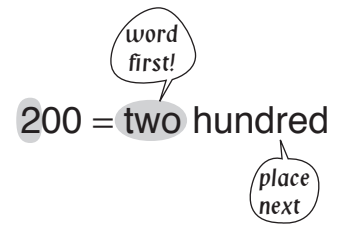
q) Express in numerals:
one million, nine hundred thousand, twenty-six

r) Express in numerals:
seven million, six hundred thousand, forty

Skill 17.4 Writing whole numbers in word form (1).

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Start from left and write the word for each digit (unless it is a 0), followed by its place name.



To write 2-digit numbers in words:

- Use a hyphen (-) to separate the word for the tens from the word for the units, for all numbers from 21 to 99; e.g. 67 is written as sixty-seven.

Hint: Some 2-digit numbers have names that do not follow the usual rules. Use the following:

10 ten	50 fifty	90 ninety	14 fourteen	18 eighteen
20 twenty	60 sixty	11 eleven	15 fifteen	19 nineteen
30 thirty	70 seventy	12 twelve	16 sixteen	
40 forty	80 eighty	13 thirteen	17 seventeen	

To write 3-digit numbers in words:

- Describe the number of hundreds first. Always write 'hundred' not 'hundreds'.
- Hints: The word "and" is unnecessary except for the numbers between 100 and 110.*

To write 4-digit numbers in words:

- Describe the number of thousands first. Always write 'thousand' not 'thousands'.
- Hints: The comma is now commonly omitted in writing 4-digit whole numbers.*

To write 5-digit numbers in words:

- Describe the number of thousands by following the rules for 2-digit numbers.

To write 6-digit numbers in words:

- Describe the number of thousands by following the rules for 3-digit numbers.

Q. Write the number 7069 in words.

A. *seven thousand sixty-nine*

Th.	H	T	U
7	0	6	9

7 thousands, 0 hundreds, 6 tens and 9 units become in words:
seven thousand sixty-nine

a) Write the number 318 in words.

three hundred eighteen

b) Write the number 65 in words.

c) Write the number 90 in words.

d) Write the number 413 in words.

e) Write the number 706 in words.

f) Write the number 520 in words.

Skill 17.4 Writing whole numbers in word form (2).**g)** Write the number 800 in words.**h)** Write the number 609 in words.**i)** Write the number 570 in words.**j)** Write the number 1600 in words.**k)** Write the number 4200 in words.**l)** Write the number 2004 in words.**m)** Write the number 5007 in words.**n)** Write the number 3012 in words.**o)** Write the number 8040 in words.**p)** Write the number 35,000 in words.**q)** Write the number 86,000 in words.**r)** Write the number 19,000 in words.**s)** Write the number 10,700 in words.**t)** Write the number 24,300 in words.**u)** Write the number 15,090 in words.**v)** Write the number 17,008 in words.**w)** Write the number 903,000 in words.**x)** Write the number 406,000 in words.**y)** Write the number 102,000 in words.**z)** Write the number 905,000 in words.

Skill 17.5 Rounding whole numbers to a given place.

MMBlue 11 22 3 44
MMGreen 11 22 33 44

- Circle the digit to the right of the requested place.
- If this digit is 0, 1, 2, 3 or 4 (< 5) - **round down** - keep the digit in the requested place the same.
5, 6, 7, 8 or 9 (≥ 5) - **round up** - add 1 to the digit in the requested place.
- Keep the number of digits in the answer the same as in the question by using zeros to fill the vacated spaces.

Q. Round 4067 to the nearest hundred.

A. 4100

Th.	H	T	U
4	0	6	7

 \Rightarrow

Th.	H	T	U
4	1	0	0

The digit to the right of the hundreds place is 6.

$6 \geq 5$ so round up.

Add 1 to the 0 in the hundreds place to make 1.

Put zeros in the tens and units places.

a) Round 12,360 to the nearest thousand.

12,360 \Rightarrow 12,000

3 < 5 round down by keeping 2

b) Round 345 to the nearest ten.

\Rightarrow

c) Round 2574 to the nearest hundred.

\Rightarrow

d) Round 806 to the nearest ten.

\Rightarrow

e) Round 221 to the nearest ten.

\Rightarrow

f) Round 34,220 to the nearest thousand.

\Rightarrow

g) Round 1657 to the nearest hundred.

\Rightarrow

h) Round 71,635 to the nearest thousand.

\Rightarrow

i) Round 4907 to the nearest ten.

\Rightarrow

j) Round 1449 to the nearest hundred.

\Rightarrow

k) Round 20,506 to the nearest thousand.

\Rightarrow

l) Round 3650 to the nearest hundred.

\Rightarrow

m) Round 168 to the nearest ten.

\Rightarrow

n) Round 5630 to the nearest hundred.

\Rightarrow

Skill 17.6 Rounding decimal numbers to a given place.

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

To round a decimal number to the nearest whole number:

- Circle the first digit after the decimal point.
- If this digit is: 0, 1, 2, 3 or 4 (< 5) - **round down** - keep the unit digit unchanged and drop all the digits after the decimal point.
- 5, 6, 7, 8 or 9 (≥ 5) - **round up** - add 1 to the unit digit and drop all the digits after the decimal point.

To round a decimal number to a given place (tenths, hundredths, thousandths):

- Circle the digit to the right of the requested place.
- If this digit is: 0, 1, 2, 3 or 4 (< 5) - **round down** - keep the digit in the requested place unchanged and drop all following digits.
- 5, 6, 7, 8 or 9 (≥ 5) - **round up** - add 1 to the digit in the requested place and drop all following digits.

Q. Round 2.75 to the nearest whole number.

A. 3

Units	Tenths	Hundredths	⇒	Units	Tenths	Hundredths
2	7	5		3	0	0

The first digit after the decimal point is 7.

$7 \geq 5$ so round up.

Add 1 to the 2 in the units place to make 3.

Omit the digits after the decimal point.

a) Round 13.4 to the nearest whole number.

13.4 \Rightarrow
 4 < 5 round down by keeping 3

b) Round 17.97 to the nearest whole number.

c) Round 45.85 to the nearest whole number.

d) Round 2.468 to the nearest whole number.

e) Round 1.8736 to the nearest thousandth.

1.8736 \Rightarrow
 6 \geq 5 round up by adding 1 to 3

f) Round 18.683 to the nearest hundredth.

g) Round 0.59 to the nearest tenth.

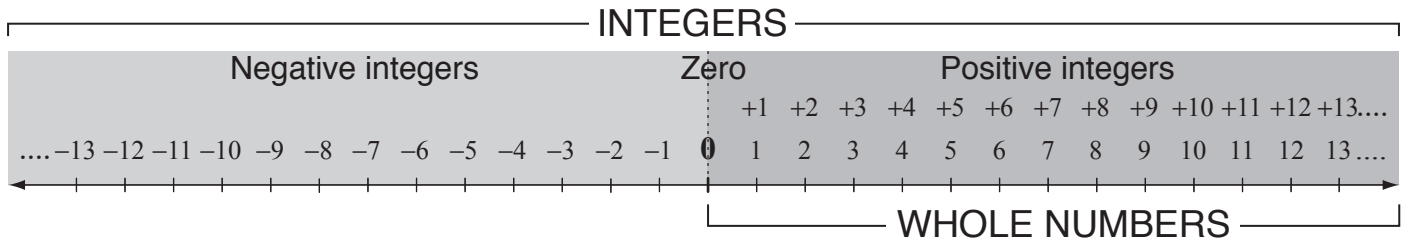
h) Round 9.81 to the nearest tenth.

i) Round 7.843 to the nearest hundredth.

j) Round 0.0856 to the nearest thousandth.

k) Round 0.52 to the nearest tenth.

l) Round 0.1968 to the nearest thousandth.



- Decide if a number is a whole number or an integer, based on their definition and the hints below. (see Glossary)

Hints: *Negative integers, fractions and decimals are not whole numbers.*

Any positive fraction whose numerator is divisible by the denominator is a whole number: $\frac{6}{3} = 2$

Any positive decimal with only zeros after the decimal point is a whole number: $8.00 = 8$

Fractions and decimals are not integers.

Any fraction whose numerator is divisible by the denominator is an integer: $-\frac{5}{1} = -5$

Any decimal with only zeros after the decimal point is an integer: $-3.00 = -3$

- Q.** Choose the whole numbers from this list:

$-19, 8.2, \frac{6}{2}, -\frac{7}{5}, 34, 0$

A. *-19 is negative, so not a whole number*

8.2 is a decimal, so not a whole number

$\frac{6}{2} = 6 \div 2 = 3$ is a whole number

$-\frac{7}{5}$ is a fraction, so not a whole number

So $\frac{6}{2}, 34, 0$ are whole numbers.

- a)** Choose the whole numbers from this list:

$\textcircled{68}, \frac{9}{5}, -31, 0.24, \textcircled{7}$

68, 7

- b)** Choose the whole numbers from this list:

$7\frac{1}{6}, 52, -100, 3.14, 98$

- c)** Choose the whole numbers from this list:

$\frac{3}{10}, 79, -95, 4.86, 21$

- d)** Choose the whole numbers from this list:

$0.095, \frac{8}{11}, 250, -72, 13$

- e)** Choose the integers from this list:

$-1512, \frac{1}{14}, 54.32, 48, 60$

- f)** Choose the integers from this list:

$21, 1\frac{1}{9}, -4, -3.27, 7500$

- g)** Choose the integers from this list:

$-63, \frac{3}{5}, 0.72, 0, -824$

- h)** Choose the integers from this list:

$\frac{25}{5}, 7.823, -1, -\frac{4}{7}, 110$

- i)** Choose the integers from this list:

$-0.68, \frac{12}{4}, 71, -54, -1039$

- j)** Choose the integers from this list:

$30, -11, \frac{10}{2}, 6.25, 4000$

Skill 17.8 Writing very large and very small numbers in scientific notation.

<p>581,000 = 5.81×10^5</p> <p>Standard Form Very large</p>	<p>0.000347 = 3.47×10^{-4}</p> <p>Standard Form Very small</p>
<p>Scientific Notation Product of: Number ≥ 1 and < 10 Power of 10 with positive exponent</p>	<p>Scientific Notation Product of: Number ≥ 1 and < 10 Power of 10 with negative exponent</p>

To find the number greater than or equal to 1 and less than 10:

- Move the decimal point after the first non-zero digit and count the places moved.
- Write this number ignoring the zeros at either end.

To find the power of 10:

- Write base 10 with an exponent equal to the number of places moved.
- Check the sign of the exponent: Decimal point moves left \Rightarrow positive exponent.
Decimal point moves right \Rightarrow negative exponent.

Q. The US postal services process and deliver more than 212 billion pieces of mail (letters, cards, ads, bills, payments and packages) every year. Write this number in scientific notation.

A. $212 \text{ billion} = 212 \times 1,000,000,000 =$
 $= \overbrace{212,000,000,000}^{11 \text{ places left}}$
 $= 2.12 \times 100,000,000,000$ $\overbrace{11 \text{ zeros}}$
 $\underbrace{\hspace{10em}}_{\text{number } \geq 1 \text{ and } < 10} = \mathbf{2.12 \times 10^{11}}$

a) The original movie Star Wars was shot on an estimated budget of 13 million dollars. Write this number in scientific notation.

$\overbrace{13,000,000}^{7 \text{ places}}$
 $= \underbrace{1.3 \times 10,000,000}_{7 \text{ zeros}} = \mathbf{1.3 \times 10^7}$

b) 400,000,000 written in scientific notation is:
 A) 4×10^8
 B) 4×10^9
 C) 4×10^{10}

= _____ =

c) In 2002 Japanese mathematicians used a supercomputer to accurately compute pi (π) to 1,241,100,000,000 digits. Write this number in scientific notation.

= _____ =

d) About 14% of the USA population moves every year, generating more than 46 million address changes. Write this number in scientific notation.

= _____ =

e) The diameter of a human hair is 0.001 inches. Write this number in scientific notation.

= _____ =

f) The smallest insect in the world is the fairy fly with a size of 0.0002 m. Write this number in scientific notation.

= _____ =

Skill 17.9 Writing numbers in standard form.

5.81×10^5 Scientific Notation Product of: Number ≥ 1 and < 10 Power of 10 with positive exponent	=	$581,000$ Standard Form Very large
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3.47×10^{-4} Scientific Notation Product of: Number ≥ 1 and < 10 Power of 10 with negative exponent	=	0.000347 Standard Form Very small
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If the power of 10 is **positive**:

- Move the decimal point to the right as many places as the power of 10.
- Add zeros as place holders if necessary.
Example: $3.1 = 3.1000$

If the power of 10 is **negative**:

- Move the decimal point to the left as many places as the power of 10.
- Add zeros as place holders if necessary.
Example: $4.5 = 00004.5$
- If the result is less than 1, write a zero in the units place.

Q. Write 8.5×10^{-6} in standard form.

A. 8.5×10^{-6} exponent = -6
 $= 0000008.5 \times 10^{-6}$ move decimal point 6 places left
add zeros as place holders
 $= 0.0000085$

a) 2.8×10^9 written in standard form is:

- A) 28,000,000,000
- B) 2,800,000,000
- C) 280,000,000

$2.8 \times 10^9 =$ exponent = +9
 $= 2,800,000,000.00$ 9 places right \Rightarrow B

b) 1.46×10^7 written in standard form is:

- A) 146,000,000
- B) 1,460,000
- C) 14,600,000

$=$ _____ \Rightarrow

c) During an average lifetime, a human eats around 6×10^4 pounds of food. Write this number in standard form.

$=$ _____ $=$

d) Lightning reaches 5×10^5 degrees Fahrenheit. Write this number in standard form.

$=$ _____ $=$

e) The size of a water molecule is 2.78×10^{-10} m. Write this number in standard form.

$=$

f) 9.5×10^{-6} written in standard form is:

- A) 0.0000095
- B) 0.000095
- C) 0.00095

$=$ _____ \Rightarrow

Skill 17.10 Recognizing rational numbers.

A number is **rational** if:

- It can be written as a fraction (ratio) of two integers.

Hints: All integers are rational numbers: $-2, 0, 700, \frac{5}{1}, \frac{25}{5}$

All terminating decimals are rational numbers: $2.16, -5.753469$

All fractions are rational numbers: $-\frac{3}{4}, \frac{12}{85}, \frac{23}{500}$

All square roots of perfect squares are rational numbers: $\sqrt{9}, \sqrt{16}$

Q. Which numbers are rational?

- A) 0.17 B) π
C) $\sqrt{3}$ D) -26

- A.** A) 0.17 is rational (terminating decimal)
B) π is not rational (an infinite non-repeating decimal)
C) $\sqrt{3}$ is not rational (square root of a prime number)
D) -26 is rational (negative integer)
So **A and D** are rational.

a) Choose the rational numbers from the list:

$\sqrt{12}, \left(\frac{1}{3}\right), (7.95), \pi, (-24)$

b) Choose the rational numbers from the list:

$-150, \frac{\pi}{2}, 0.72, \frac{18}{101}, -\sqrt{6}$

c) Choose the rational numbers from the list:

$-\frac{19}{3}, 3.1415, \sqrt{80}, 15, -4$

d) Choose the rational numbers from the list:

$\frac{14}{569}, 98, 3.58904, \sqrt{50}, -79$

e) Which numbers are rational?

- A) $\sqrt{10}$ B) π
C) 3.1415 D) $\frac{7}{8}$

f) Which numbers are rational?

- A) π B) 0.0004
C) $\frac{3}{4}$ D) $\sqrt{20}$

g) Which numbers are rational?

- A) 8.2323 B) $\sqrt{3}$
C) $1\frac{1}{7}$ D) $-\frac{\pi}{4}$

h) Which numbers are rational?

- A) -1 B) $\sqrt{5}$
C) $\frac{\pi}{3}$ D) $\frac{23}{800}$

i) Which is **not** a rational number?

- A) $\sqrt{7}$ B) -360
C) 2.518 D) $-\frac{4}{9}$

j) Which is **not** a rational number?

- A) 0.085 B) -1996
C) $-\frac{\pi}{2}$ D) $\frac{34}{71}$