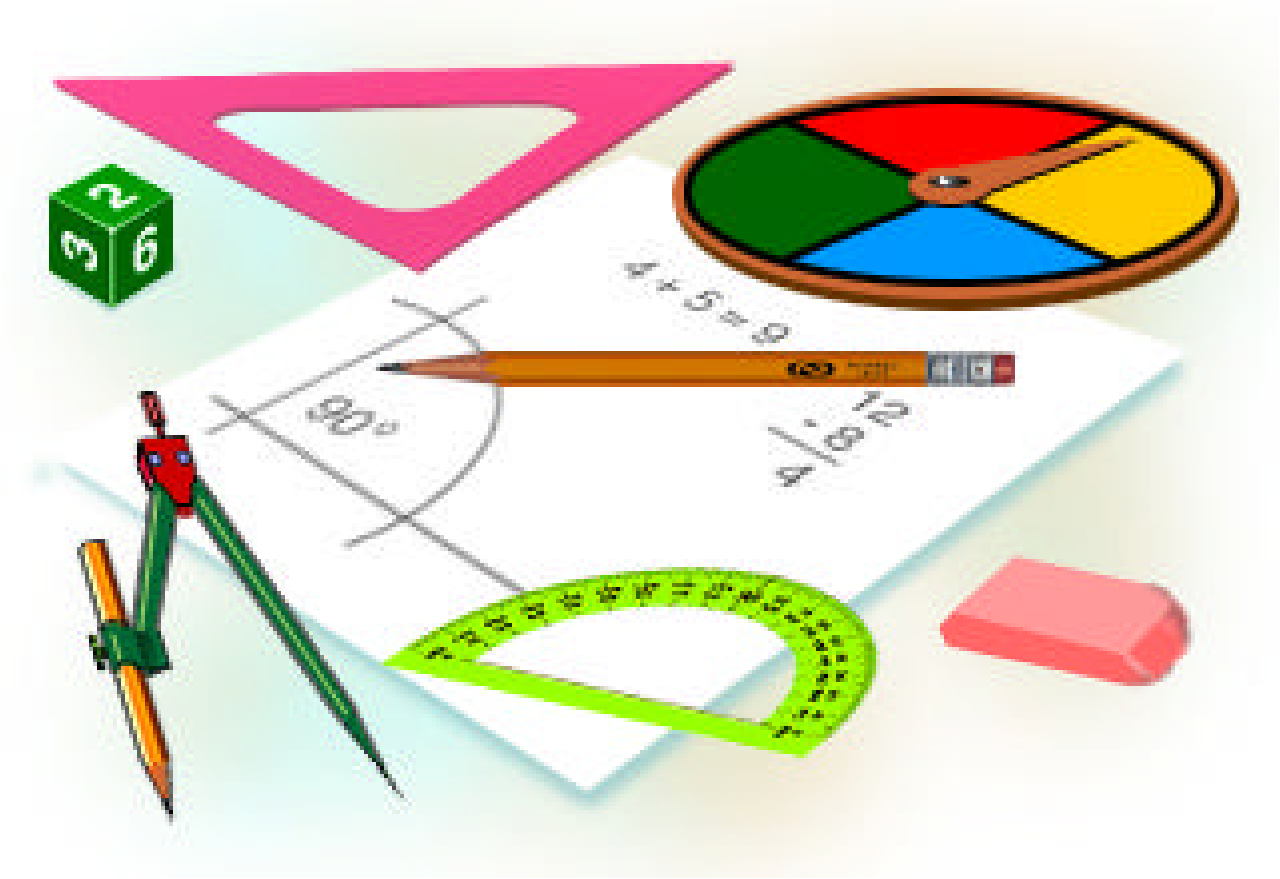
The Next Step

Mathematics Applications for Adults



Book 14015 - Decimals

OUTLINE

Mathematics - Book 14015

Decimals
Understanding and Comparing Decimals
organize a list of decimals and mixed decimals in ascending and descending order.
convert fractions to decimals.
compare two decimals using “<” and “>” signs.
Addition of Decimals
add numbers containing decimals.
Subtraction of Decimals
subtract numbers containing decimals.
Multiplication of Decimals
multiply numbers containing decimals.
Division of Decimals
divide numbers containing decimals.
Word Problems with Decimals
solve one/two step problems with addition, subtraction, multiplication, and division of decimals.

THE NEXT STEP

Book 14015

Decimals

Understanding and Comparing Decimals

The numerals we use today are called ***decimal*** numerals. These numerals stand for the numbers in the decimal system. The decimal system is also known as the Arabic system. The decimal system was first created by Hindu astronomers in India over a thousand years ago. It spread into Europe around 700 years ago.

The ***decimal system*** uses ten symbols: ***0, 1, 2, 3, 4, 5, 6, 7, 8,*** and ***9***. The word "decimal" comes from the Latin root ***decem***, meaning "ten."

Comparing Decimals

Comparing decimals uses an important mathematical concept. You can add zeros to the right of the last decimal digit without changing the value of the number. Study these examples.

RULE When comparing decimals with the same number of decimal places, compare them as though they were whole numbers.

Example Which is greater, 0.364 or 0.329?
Both numbers have three decimal places.
Since 364 is greater than 329, the decimal **0.364 > 0.329.**

The rule for comparing whole numbers in which the number with more digits is greater does not hold true for decimals. The decimal number with more decimal places is not necessarily the greater number.

RULE When decimals have a different number of digits, write zeros to the right of the decimal with fewer digits so the numbers have the same number of decimal places. Then compare.

Example Which is greater, 0.518 or 0.52?
Add a zero to 0.52.
Since 520 > 518, the decimal **0.52 > 0.518.**

RULE When numbers have both whole number and decimal parts, compare the whole numbers first.

Example 1 Compare 32.001 and 31.999.
Since 32 is greater than 31, the number **32.001 is greater than 31.999.** It does not matter that 0.999 is greater than 0.001.

Using the same rules, you can put several numbers in order according to value. When you have several numbers to compare, write the numbers in a column and line up the decimal points. Then add zeros to the right until all the decimals have the same number of decimal digits.

Example 2 A digital scale displays weight to thousandths of a pound. Three packages weigh 0.094 pound, 0.91 pound, and 0.1 pound. Arrange the weights in order from greatest to least.

Step 1 Write the weights in a column, aligning the decimal point.

0.094
0.910

Step 2 Add zeros to fill out the columns.

0.100

Step 3 Compare as you would whole numbers.

In order from greatest to least, the weights are **0.91, 0.1,** and **0.094 pound.**

Equivalent Decimals

Decimals that name the same number or amount

Example:

0.5 = 0.50 = 0.500

Practice Exercise

Compare Decimals

Compare the given decimals.

1.	0.9290	=	0.929
2.	0.94	_____	0.49
3.	0.862000	_____	0.862
4.	0.260	_____	0.62
5.	0.70800	_____	0.708
6.	0.63	_____	0.36
7.	0.952	_____	0.952
8.	0.46	_____	0.02
9.	0.826	_____	0.823
10.	558.763	_____	559.763
11.	0.89100	_____	0.891
12.	0.25	_____	0.091
13.	39.540	_____	39.565
14.	0.62000	_____	0.62
15.	8256.834	_____	8265.834

16.	0.67500	_____	0.675
17.	0.96	_____	9.6
18.	0.35	_____	0.99
19.	0.41	_____	6.3

Decimals and Place Value

Decimal

A number that uses place value and a decimal point to show values less than one, such as tenths and hundredths

Example:

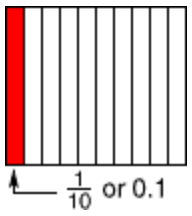
3.47

	hundreds	tens	ones	Decimal point	tenths	hundredths	thousandths
10 $\frac{1}{10}$		1	0	.	1		
205 $\frac{3}{100}$	2	0	5	.	0	3	
4 $\frac{9}{1000}$			4	.	0	0	9

Tenth

One of ten equal parts

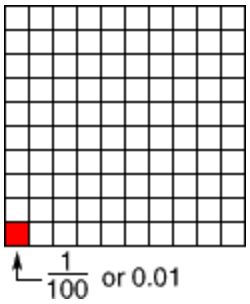
Example:



Hundredth

One of one hundred equal parts

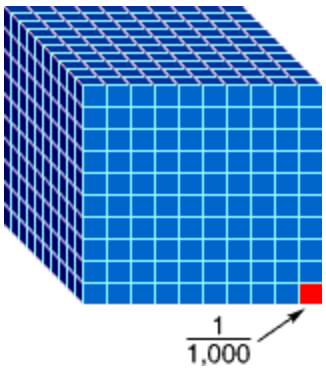
Example:



Thousandth

One part of 1,000 equal parts

Example:



Þ ***In decimal notation, a decimal point distinguishes whole numbers from decimal fractions:***

$$1 = 1.0$$

$$\frac{1}{10} = 0.1$$

$$1\frac{1}{10} = 1.1$$

How do you write 16.034 in words?

Read the whole number part of the number. Say *and* to represent the decimal point. Read the digits to the right of the decimal point, and say the place name of the last digit on the right. Note that there are no commas setting off groups of three digits in the decimal part of the number to the right of the decimal point.

The number 16.034 is read ***sixteen and thirty-four thousandths.***

Þ **Be careful!!! Although most Canadians and Americans recognize the "." as a decimal point, the decimal point is expressed as a comma in many countries. Most French Canadians use the comma to represent the decimal point.**

Practice Exercise

Number Words

Read the number word and write the number.

1. two tenths **0.2**
2. one hundredth _____
3. six thousandths _____
4. two thousandths _____
5. eighty-three hundredths _____
6. six hundred sixty-five thousandths _____
7. six hundred eighty-six and eight hundred thirty-one thousandths _____
8. three and eighty-two thousandths _____
9. sixty-five and seventy-six hundredths _____
10. fourteen and eight hundred thirteen thousandths _____
11. seventeen and twenty-five thousandths _____
12. four hundred ninety-six and sixty-one hundredths _____
13. four hundred ninety and six hundred thirty thousandths _____
14. eighty hundredths _____
15. eighty-four and ninety-five hundredths _____

16. one hundred sixty thousandths _____

17. seven hundred five and fifty-eight hundredths _____

Number Words

Write the numeral as a number word.

1. 0.6 **six tenths**
2. 0.07 _____
3. 0.004 _____
4. 0.2 _____
5. 70.971 _____
6. 44.89 _____
7. 18.039 _____
8. 0.64 _____
9. 0.668 _____
10. 355.88 _____
11. 82.197 _____
12. 227.940 _____
13. 15.084 _____
14. 0.462 _____
15. 833.16 _____
16. 19.20 _____
17. 0.62 _____

Decimal Fractions and Decimal Numbers

Decimal fractions or ***decimals*** are fractions with denominators of ***10***, ***100***, ***1,000***, ***10,000***, and so on.

Decimal fractions are written using a decimal point:

$$\frac{1}{10} = .1 \qquad \frac{1}{100} = .01 \qquad \frac{1}{1000} = .001$$

Changing a Fraction to a Decimal

Any fraction can be written as a decimal by dividing the numerator by the denominator, and adding a decimal point in the correct place.

$$\frac{1}{10} = 10\overline{)1.0}\ .1 \qquad \frac{3}{5} = 5\overline{)3.0}\ .6 \qquad \frac{1}{4} = 4\overline{)1.00}\ .25$$

Write each fraction in decimal format.

1. $\frac{54}{100}$ = **0.54**

2. $\frac{4}{10}$ = ____

3. $\frac{78}{100}$ = ____

4. $\frac{3}{4} =$ ____

5. $\frac{3}{5} =$ ____

6. $\frac{6}{30} =$ ____

7. $\frac{23}{50} =$ ____

8. $\frac{32}{64} =$ ____

9. $\frac{8}{10} =$ ____

10. $\frac{51}{75} =$ ____

11. $\frac{16}{20} =$ ____

12. $\frac{45}{60} =$ ____

13. $\frac{54}{60} =$ ____

14. $\frac{4}{5} =$ ____

15. $\frac{24}{50} =$ ____

16. $\frac{32}{40} =$ ____

17. $\frac{2}{5} =$ ____

18. $\frac{164}{200} =$ ____

19. $\frac{1}{5} =$ ____

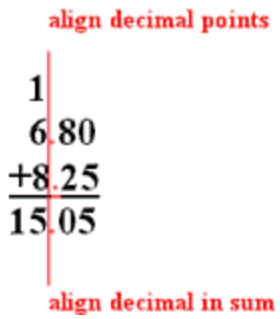
20. $\frac{45}{50} =$ ____

21. $\frac{51}{60} =$ ____

Addition of Decimals

Adding decimals is easy.

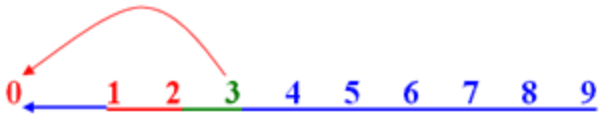
First, align the decimal points of the decimals. Then treat decimal fractions like whole numbers, aligning the decimal point in the sum. Adding decimals may look familiar---it's just like adding money.



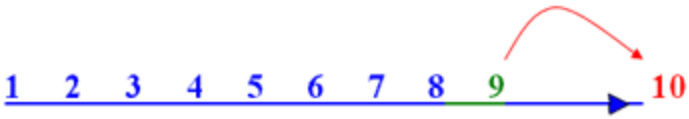
Estimating can be a very useful skill. In many everyday situations involving money, for example, you do not need exact amounts. You can estimate when you want to know if you have enough cash to pick up the three things you want at the grocery store or about how much each person should contribute to split the cost of lunch. In such cases, you can use amounts rounded to the nearest dollar (the ones place).

Rounding means to express a number to the nearest given place. The number in the given place is increased by one if the digit to its right is 5 or greater. The number in the given place remains the same if the digit to its right is less than 5. When rounding whole numbers, the digits to the right of the given place become zeros (digits to the left remain the same). When rounding decimal numbers, the digits to the right of the given place are dropped (digits to the left remain the same).

If you are rounding 3 to the nearest tens place, you would round down to 0, because 3 is closer to 0 than it is to 10.



If you were rounding 9, you would round up to 10.



General Rule for Rounding to the Nearest 10, 100, 1,000, and Higher!

Round down from numbers under 5 and round up from numbers 5 and greater.

The same holds true for multiples of 10. Round to the nearest 100 by rounding down from 49 or less and up from 50 or greater. Round to the nearest 1,000 by rounding down from 499 or less and up from 500 or greater.

Example Using the following price list, about how much would Pat pay for a steering wheel cover, a wide-angle mirror, and an oil drip pan?

Auto Parts Price List

Outside Wide-Angle Mirror	$13.45
Steering Wheel Cover	$15.95
Oil Drip Pan	$ 8.73
Windshield Washer Fluid	$ 2.85
Brake Fluid	$ 6.35

Round the cost of each item to the nearest dollar and find the total of the estimates.

Item	**Cost**	**Estimate**
Steering wheel cover	$15.95	$16
Wide-angle mirror	13.45	13
Oil drip pan	+ 8.73	+ 9
Total:	$38.13	$38

The best estimate is **$38** which is close to the actual cost of **$38.13.**

Practice Exercise

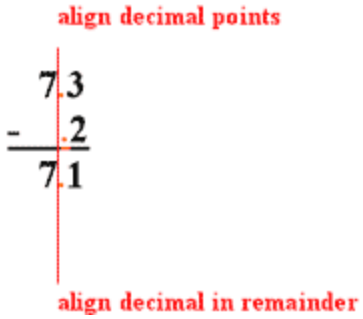
Solve each problem.

1. 27.3 + 94.6	**2.** 9.4 + 4.3	**3.** 6.4 + 41.4	**4.** 9.8 + 47.3
5. 57.7 + 95.7	**6.** 2.4 + 1.7	**7.** 50.5 + 11.4	**8.** 9.8 + 84.5
9. 64.8 + 1.8	**10.** 34.7 + 32.7	**11.** 2.1 + 6.9	**12.** 6.7 + 86.7
13. 5.5 + 1.7	**14.** 27.16 + 90.36	**15.** 66.09 + 34.6	**16.** 9.69 + 28.7
17. 8.69 + 51.48	**18.** 4.5 + 3.4	**19.** 64.709 + 91.8	**20.** 40.9 + 3.2
21. 6.4 + 9.4	**22.** 39.29 + 60.6	**23.** 13.790 + 7.712	**24.** 66.54 + 21.32
25. 1.9 + 8.6	**26.** 2.112 + 9.934	**27.** 82.19 + 54.77	**28.** 5.4 + 53.6

Subtraction of Decimals

Subtracting decimals is easy.

First, align the decimal points of the decimals. Then treat decimal fractions like whole numbers, aligning the decimal point in the remainder. Subtracting decimals may look familiar---it's just like subtracting money.



To subtract decimals, if necessary, use place-holding zeros. Note: Whole numbers are understood to have a decimal point to the right of the ones place.

$$12 - 4.08 = \begin{array}{r} 12.00 \\ \underline{-4.08} \\ 7.92 \end{array}$$

Estimating can be a very useful skill. In many everyday situations involving money, for example, you do not need exact amounts. In such cases, you can use amounts rounded to the nearest dollar (the ones place).

Example Susan has $213 in a checking account. If she writes a check for $32.60, about how much will be left in the account?

Round the amount of the check off to the nearest dollar and find the difference.

$213.00	$213
- $ 32.60	- $ 33
$180.40	$180

The best estimate is **$180** which is close to the actual amount of **$180.40.**

Solve each problem.

1. 9.6 -8.69	**2.** 96.6 - 3.6	**3.** 39.5 - 8.5	**4.** 37.29 - 3.8	**5.** 95.1 -19.6
6. 9.9 - 3.4	**7.** 11.1 -9.69	**8.** 7.1 - 3.4	**9.** 51.4 -27.1	**10.** 5.8 - 2.6
11. 89.1 -70.5	**12.** 6.4 - 1.5	**13.** 9.9 - 8.5	**14.** 44.8 - 3.2	**15.** 62.6 -8.19

16. 56.15 -30.8	17. 50.4 -2.29	18. 52.28 -12.57	19. 63.5 -23.8	20. 6.2 - 4.8
21. 72.11 -54.4	22. 4.3 - 1.9	23. 62.2 - 2.8	24. 70.41 - 7.6	25. 8.9 -7.62
26. 68.9 -33.1	27. 99.3 - 3.1	28. 56.77 -4.28	29. 9.19 - 3.2	30. 95.5 -5.46
31. 6.7 - 3.5	32. 95.78 -2.44	33. 85.701 -3.723	34. 91.94 -19.5	35. 71.2 -39.6

Multiplication of Decimals

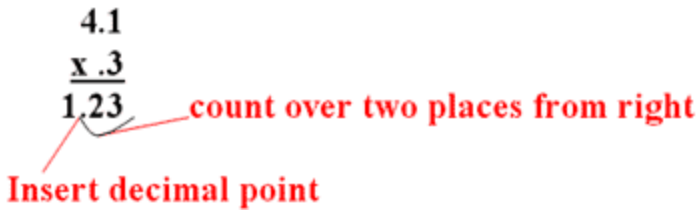
To multiply decimals, treat them as if they were whole numbers, at first ignoring the decimal point. It is not necessary to line up the decimal points when you write the question down.

4.1
x .3
123

Next, count the number of places to the right of the decimal point in the multiplicand. Add this to the number of places to the right of the decimal point in the multiplier.

4.1 multiplicand ---------- one place
x .3 multiplier ---------- +one place
two places

Last, insert the decimal point in the product by counting over from the right the appropriate number of places.



Here are two other examples:

8.9	**65.003**
x 1.0	**x .025**
0 0	**325015**
8 9 0	**1300060**
8. 9 0	**1.625075**

Estimating can be a very useful skill. In many everyday situations involving money, for example, you do not need exact amounts. In such cases, round each factor to its greatest place. Then multiply.

Example Richard earns $7.90 per hour and works 38.5 hours each week. How much are his total earnings per week?

Round each factor to its greatest place and multiply.

38.5	40 hours
$7.90	$8 per hour
3950	$320 weekly wages, estimate
6320	
2370	
$304.150	

The best estimate is **$320** which is close to the actual solution of **$304.15.**

Solve each problem.

(1)	**0.1**	**(2)**	**33**	**(3)**	**63**	**(4)**	**0.3**
	× 4		**× 0.4**		**× 0.8**		**× 8**
(5)	**64**	**(6)**	**71**	**(7)**	**19**	**(8)**	**33**
	× 0.01		**× 0.06**		**× 0.47**		**× 0.92**

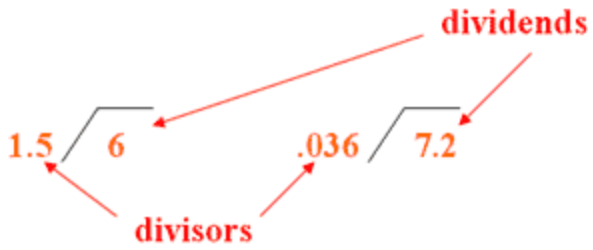
(9)	**6** × **0.48**	**(10)**	**5.2** × **2**	**(11)**	**3.7** × **99**	**(12)**	**4.4** × **78**
(13)	**47** × **0.001**	**(14)**	**14.36** × **41**	**(15)**	**11.25** × **36**	**(16)**	**48** × **10.5**
(17)	**0.1** × **21**	**(18)**	**35.14** × **23**	**(19)**	**36** × **0.001**	**(20)**	**34.6** × **40**

Division of Decimals

Begin dividing decimals the same way you would divide whole numbers.

If the number in a division box (the dividend) has a decimal, but the number outside of the division box (the divisor) does not have a decimal, place the decimal point in the quotient (the answer) directly above the decimal point in the division box.

$$5\overline{)0.010}\quad 0.002$$



(Note that 6 = 6.0.)

Estimating can be a very useful skill. In many everyday situations involving money, for example, you do not need exact amounts. In such cases, round the divisor to its greatest place, and round the dividend so that it can be divided exactly by the rounded divisor. Then divide.

Example If a plane flew 2,419.2 miles in 6.3 hours, what was its average speed in miles per hour?

Round the divisor to its greatest place, round the dividend so that it can be divided exactly by the rounded divisor, and divide.

6.3 → 6 hours
2,419.2 → 2,400 miles
2,400 ÷ 6 = 400 miles per hour, estimate
2,419.2 ÷ 6.3 = 384 miles per hour

The best estimate is **400 miles per hour** which is close to the actual answer of **384 miles per hour.**

Practice Exercise

Solve each problem.

1.	$8\overline{)129.52}$	**2.**	$9\overline{)27.45}$	**3.**	$6\overline{)24.867}$
4.	$4\overline{)1906.4}$	**5.**	$4\overline{)6.528}$	**6.**	$2\overline{)5.1}$
7.	$3\overline{)1.8105}$	**8.**	$4\overline{)6.528}$	**9.**	$5\overline{)1.28}$
10.	$3\overline{)122.1}$	**11.**	$4\overline{)6.672}$	**12.**	$3\overline{)91.095}$
13.	$2\overline{)1.49}$	**14.**	$8\overline{)569.76}$	**15.**	$5\overline{)29.881}$
16.	$9\overline{)15.246}$	**17.**	$4\overline{)1.0236}$	**18.**	$7\overline{)500.542}$

Þ **Often you will see decimal answers expressed like this: "0.98". The zero in this case is being used as a place holder to signify that there are no whole numbers in the answer. 0.98 is equivalent to .98, so either answer would be acceptable.**

Word Problems with Decimals

Solve the problems below.

1. Mrs Watson had 8.2 m of cloth. She used 1.25 m to sew 1 dress. If she sewed 6 dresses, how many metres of cloth had she left?

2. If 8 litres of gas cost $8.64. How much is 1 litre of gas?

3. Al bought 2 chickens. One chicken weighed 2.9 kg and the other is 0.4 kg heavier. If the price of the chicken is $0.90 per kg, how much did Al pay for the 2 chickens?

4. Sue and Jim have $14.40 altogether. If Jim has $10.80, how much money does Sue have?

5. Simon had $10. He bought 9 pencils at $0.25 each. He used the rest of his money to buy 5 pens. What is the price of each pen?

6. A square has sides 2.4 cm. A rectangle has the same perimeter as the square. If the length of the rectangle is 2.8 cm, what is its width?

7. The weight of 1 exercise book is 0.45 kg. The total weight of 11 exercise books and 6 scribblers is 6.75 kg. Find the weight of 1 scribbler.

8. 1 stick of butter cost $0.35 and 1 stick of beef jerky cost $0.40. Mr Owens bought 20 sticks of butter and 20 sticks of beef jerky. If he paid the cashier $20, how much change would he get?

9. Amy had 5 litres of orange juice. She poured the juice equally into 8 glasses and had 0.52 litres left. How much orange juice was there in each glass?

10. 15 grapefruit weigh13.5 kg. The weight of an apple is 0.6 kg less than that of a grapefruit. What is the weight of 4 apples?

Answer Key

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Page 6 **2.** > **3.** = **4.** < **5.** = **6.** > **7.** =
8. > **9.** > **10.** < **11.** = **12.** > **13.** <
14. = **15.** < **16.** = **17.** < **18.** < **19.** <

Page 10 **2.** 0.01 **3.** .006 **4.** .002 **5.** .83
6. .665 **7.** 686.831 **8.** 3.082 **9.** 65.76
10. 14.813 **11.** 17.025 **12.** 496.61
13. 490.630 **14.** .80 **15.** 84.95 **16.** .160
17. 705.58

Page 11 **2.** seven hundredths **3.** four thousandths **4.** two tenths **5.** seventy and nine hundred seventy-one thousandths **6.** forty-four and eighty-nine hundredths **7.** eighteen and thirty-nine thousandths **8.** sixty-four hundredths **9.** six hundred sixty-eight thousandths **10.** three hundred fifty-five and eighty-eight hundredths **11.** eighty-two and one hundred ninety-seven thousandths **12.** two hundred twenty-seven and nine hundred forty thousandths **13.** fifteen and eighty-four thousandths **14.** four hundred sixty-two thousandths **15.** eight hundred thirty-three and sixteen hundredths **16.** nineteen and twenty hundredths **17.** sixty-two hundredths

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2. .4 **3.** .75 **4.** .75 **5.** .6 **6.** .2
7. .46 **8.** .5 **9.** .8 **10.** .68 **11.** .8
12. .75 **13.** .9 **14.** .8 **15.** .48 **16.** .8
17. .4 **18.** .82 **19.** .2 **20.** .9 **21.** .85

Page 17

1. 124.9 **2.** 13.7 **3.** 47.8 **4.** 57.1
5. 153.4 **6.** 4.1 **7.** 61.9 **8.** 94.3
9. 66.6 **10.** 67.4 **11.** 9.0 **12.** 93.4
13. 7.2 **14.** 117.52 **15.** 100.69 **16.** 38.39
17. 60.17 **18.** 7.9 **19.** 156.509 **20.** 44.1
21. 15.8 **22.** 99.89 **23.** 21.502 **24.** 87.86
25. 10.5 **26.** 12.046 **27.** 136.96 **28.** 59.0

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1. .91 **2.** 93.0 **3.** 31.0 **4.** 33.49
5. 75.5 **6.** 6.5 **7.** 1.41 **8.** 3.7 **9.** 24.3
10. 3.2 **11.** 18.6 **12.** 4.9 **13.** 1.4
14. 41.6 **15.** 54.41 **16.** 25.35 **17.** 48.11
18. 39.71 **19.** 39.7 **20.** 1.4 **21.** 17.71
22. 2.4 **23.** 59.4 **24.** 62.81 **25.** 1.28
26. 35.8 **27.** 96.2 **28.** 52.49 **29.** 5.99
30. 90.04 **31.** 3.2 **32.** 93.34 **33.** 81.978
34. 72.44 **35.** 31.6

Page 22

1. .4 **2.** 13.2 **3.** 50.4 **4.** 2.4 **5.** .64
6. 4.26 **7.** 8.93 **8.** 30.36 **9.** 2.88
10. 322.4 **11.** 366.3 **12.** 343.2 **13.** .047
14. 588.76 **15.** 405 **16.** 504 **17.** 2.1
18. 808.22 **19.** .036 **20.** 1384

Page 25

1. 16.19 **2.** 3.05 **3.** 4.1445 **4.** 476.6
5. 1.632 **6.** 2.55 **7.** .6035 **8.** 52.12

9. .256 **10.** 40.7 **11.** 1.668 **12.** 30.365
13. .745 **14.** 71.22 **15.** 5.9762
16. 1.694 **17.** .2559 **18.** 71.506

Page 26 **1.** .7 m **2.** $1.08 **3.** $5.58 **4.** $3.60
5. $1.55 **6.** 2 cm **7.** .3 kg **8.** $5.00
9. .56 L **10.** 1.2 kg