

3. a) Calculate $\frac{-9}{12} \div \frac{3}{8}$ by multiplying by the reciprocal.
b) Calculate $\frac{-9}{12} \div \frac{3}{8}$ by writing the fractions with a common denominator and dividing the numerators.
c) Which method do you prefer for this calculation? Explain.

4. Joshua suggested his own method for multiplying and dividing rational numbers in fraction form. For $-\frac{4}{5} \times \frac{2}{3}$, he calculated $\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$.

Then, he reasoned that the product must be negative because $-\frac{4}{5}$ and $\frac{2}{3}$ have different signs. He gave the answer as $-\frac{8}{15}$. Describe an advantage and a disadvantage of Joshua's method.

Practise

For help with #5 and #6, refer to Example 1 on page 64.
Write your answers in lowest terms.

5. Estimate and calculate.

- a) $\frac{3}{10} + \frac{1}{5}$ b) $2\frac{1}{3} + (-1\frac{1}{4})$
c) $-\frac{5}{12} - \frac{5}{12}$ d) $-2\frac{1}{2} - (-3\frac{1}{3})$
e) $-\frac{5}{6} + \frac{1}{3}$ f) $\frac{3}{8} - (-\frac{1}{4})$

6. Estimate and calculate.

- a) $\frac{2}{3} - \frac{3}{4}$ b) $-\frac{2}{9} + (-\frac{1}{3})$
c) $-\frac{1}{4} + (-\frac{3}{5})$ d) $-\frac{3}{4} - (-\frac{5}{8})$
e) $1\frac{1}{2} - 2\frac{1}{4}$ f) $1\frac{2}{5} + (-1\frac{3}{4})$

For help with #7 and #8, refer to Example 2 on page 65.
Write your answers in lowest terms.

7. Estimate and calculate.

- a) $\frac{4}{5} \div \frac{5}{6}$ b) $3\frac{1}{3}(1\frac{3}{4})$
c) $\frac{1}{8} \times (-\frac{2}{5})$ d) $-\frac{9}{10} \div (-\frac{4}{5})$
e) $-\frac{3}{8} \times 5\frac{1}{3}$ f) $\frac{1}{10} \div (-\frac{3}{8})$

8. Estimate and calculate.

- a) $-\frac{3}{4} \times (-\frac{1}{9})$ b) $1\frac{1}{3} \div 1\frac{1}{4}$
c) $-\frac{3}{8} \div \frac{7}{10}$ d) $-2\frac{1}{8} \div 1\frac{1}{4}$
e) $\frac{7}{9}(-\frac{6}{11})$ f) $-1\frac{1}{2} \div (-2\frac{1}{2})$

For help with #9 and #10, refer to Example 3 on page 66.

9. Lori owed her mother \$39. Lori paid back $\frac{1}{3}$ of this debt and then paid back $\frac{1}{4}$ of the remaining debt.

How much does Lori still owe her mother?

10. A carpenter has 64 m of baseboard. He installs $\frac{1}{2}$ of the baseboard in one room. He installs another $\frac{3}{5}$ of the original amount of baseboard in another room. How much baseboard does he have left?

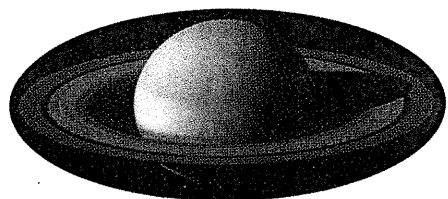
Apply

11. In everyday speech, *in a jiffy* means in a very short time. In science, a specific value sometimes assigned to a jiffy is $\frac{1}{100}$ s. Naima can type at 50 words/min. On average, how many jiffies does she take to type each word?

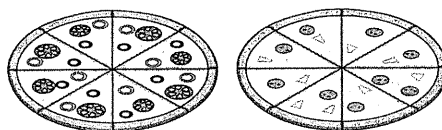
12. In the table, a positive number shows how many hours the time in a location is ahead of the time in London, England. A negative number shows how many hours the time is behind the time in London.

Location	Time Zone
Alice Springs, Australia	$+9\frac{1}{2}$
Brandon, Manitoba	-6
Chatham Islands, New Zealand	$+12\frac{3}{4}$
Istanbul, Turkey	+2
Kathmandu, Nepal	$+5\frac{3}{4}$
London, England	0
Mumbai, India	$+5\frac{1}{2}$
St. John's, Newfoundland and Labrador	$-3\frac{1}{2}$
Tokyo, Japan	+9
Victoria, British Columbia	-8

- a) How many hours is the time in St. John's ahead of the time in Brandon?
- b) How many hours is the time in Victoria behind the time in Mumbai?
- c) Determine and interpret the time difference between Tokyo and Kathmandu.
- d) Determine and interpret the time difference between Chatham Islands and St. John's.
- e) In which location is the time exactly halfway between the times in Istanbul and Alice Springs?
13. The diameter of Pluto is $\frac{6}{17}$ the diameter of Mars. Mars is $\frac{17}{300}$ the diameter of Saturn.
- a) What fraction of the diameter of Saturn is the diameter of Pluto?
- b) The diameter of Saturn is 120 000 km. What is the diameter of Pluto?



14. Li and Ray shared a vegetarian pizza and a Hawaiian pizza of the same size. The vegetarian pizza was cut into eight equal slices. The Hawaiian pizza was cut into six equal slices. Li ate two slices of the vegetarian pizza and one slice of the Hawaiian pizza. Ray ate two slices of the Hawaiian pizza and one slice of the vegetarian pizza.



- a) Who ate more pizza?
- b) How much more did that person eat?
- c) How much pizza was left over?
15. Predict the next three numbers in each pattern.
- a) $-1\frac{1}{2}, -\frac{7}{8}, -\frac{1}{4}, \frac{3}{8}, 1, \dots$
- b) $1\frac{1}{3}, -\frac{2}{3}, \frac{1}{3}, -\frac{1}{6}, \frac{1}{12}, \dots$
16. Boris has $2\frac{1}{2}$ times as much cash as Anna. Charlie has $\frac{3}{4}$ as much cash as Anna. Anna has \$25.60 in cash.
- a) How much cash do the three people have altogether?
- b) How much more cash does Boris have than Charlie?
17. To calculate $-\frac{3}{4} + \left(-\frac{2}{3}\right)$, Amy decided to convert the fractions to decimals and add the decimals on a scientific calculator.
- a) Explain why she had difficulty in determining the exact answer by this method.
- b) How should she calculate to get an exact answer?

Order of Operations (B-3)

Example: Which operation do you need to complete first in the expression below? List the operations in order to evaluate the question.

$$5 - (-3)^3 \div 9 =$$

•
•
•

The rules for the order of operations are

- Do what is in brackets first
- Operate on exponents
- Multiply & divide from left to right
- Add & subtract from left to right

Remember the mnemonic **Brackets**

Or....

Exponents

Division

BEDMAS

Multiplication

Addition

Subtraction

Practice

1. Two math teachers incorrectly evaluated the questions below. Why is each answer incorrect?

$\begin{aligned} &(-8) - 2(24 \div (-8))^2 \\ &= (-10)(24 \div (-8))^2 \\ &= (-10)(-3)^2 \\ &= (-10)(9) \\ &= -90 \end{aligned}$	$\begin{aligned} &(-8) - 2(24 \div (-8))^2 \\ &= (-8) - 2(-3)^2 \\ &= (-8) - (-6)^2 \\ &= -8 - 36 \\ &= -44 \end{aligned}$
--	--

2. What is the correct answer?

Order of Operations (B-3) Practice 1

Evaluate the following expressions without a calculator. Show one step at a time.

1. $-3.6 - 2.1 \times (-0.2)$

7. $\left(\frac{4}{5} + \left(2\frac{3}{4} - \frac{1}{3}\right)\right)$

2. $-0.5 \times 360 \div 0.6$

3. $\frac{(-600)(0.6)}{2(3-9)}$

8. $\left(\frac{3}{4} + \left(1\frac{5}{6} + \frac{1}{3}\right) + \right) - \frac{3}{4}$

4. $\frac{1}{3} + \frac{1}{3} \div \frac{1}{6}$

5.. $\frac{(-30)(0.8)}{0.2(0.3)}$

6. $\frac{3 + 27 \div 3 + 4}{2}$

Rationals Problem Solving

requiring some deeper mathematical reasoning
(N5 – Operations on Rationals)

- 1) Fully explain why the fractions $\frac{6}{8}$ and $\frac{9}{12}$ are equivalent by using a VISUAL.
- 2) Mr. Burns has $\frac{4}{6}$ of plutonium rod A. Smithers has $\frac{6}{9}$ of plutonium rod B.
- a) Do Mr. Burns and Smithers have the same amount of plutonium rod? (answer with “yes,” “no,” or “maybe”).
- b) Give your answer VISUALLY for part a.
- 3) Homer got his monthly paycheck on Monday, and he then spent some money on Tuesday, Wednesday, and Thursday. On Tuesday, Homer spent one-fifth of his monthly paycheck on mortgage payments. On Wednesday, he spent seven-twelfths of what he had left on food and clothing. On Thursday, he spent three-tenths of what he then had left on his children. What fraction portion of his monthly paycheck is now left?
- 4) Bart had $\frac{5}{16}$ of a bag of candy left and Lisa had $\frac{3}{8}$ of the same size bag of candy remaining. Bart and Lisa get into a fight, so Marge takes all of their candy and gives it to Maggie, who had no candy to begin with.
- a) How much candy does Maggie have now? Give your answer VISUALLY, and explain completely.
- 5) a) Draw $1/5 \times 1/4$ using a visual. It might help to think of it as $1/5$ of $1/4$.
b) Solve (give the final answer) and explain completely.
- 6) Suppose you have $6\frac{1}{2}$ pounds of hamburger. You want to store the hamburger in freezer bags that hold $\frac{3}{4}$ of a pound each. Once all of the hamburger has been packaged in the freezer bags, exactly how many bags will be full? (report fraction parts of bags as well, if applicable).
- a) Solve the problem above by using a VISUAL representation. Explain completely.

ASSESSMENT

Concept of a fraction 1,2

Add/Subtract 3,4

Mult/Divide 5,6

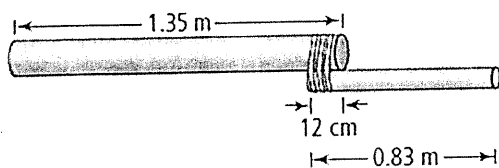
Adding & Subtracting Rational Numbers Problem Solving

1. In Regina, Saskatchewan, the average mid-afternoon temperature in January is -12.6°C . The average mid-afternoon temperature in July is 26.1°C . How many degrees colder is Regina in January than in July?

2. A pelican dives vertically from a height of 3.8 m above the water. It then catches a fish 2.3 m underwater.

- Write an expression using rational numbers to represent the length of the pelican's dive.
- How long is the pelican's dive?

3. Two wooden poles measured 1.35 m and 0.83 m in length. To make a new pole, they were attached by overlapping the ends and tying them together. The length of the overlap was 12 cm. What was the total length of the new pole in metres?



4. In a magic square, the sum of each row, column, and diagonal is the same. Copy and complete this magic square.

$-\frac{1}{2}$		
	$-\frac{5}{6}$	
	$\frac{1}{2}$	$-1\frac{1}{6}$

5. Can the sum of two rational numbers be less than both of the rational numbers? Explain using examples in fraction form.

6. Write a subtraction statement involving two negative fractions or negative mixed numbers so that the difference is $-\frac{4}{3}$.

2.5 Multiplying Fractions

MATHPOWER™ Eight, pp. 56–57

To multiply fractions, multiply the numerators and multiply the denominators.

$$\begin{aligned} 2\frac{1}{3} \times 1\frac{4}{5} &= \frac{7}{3} \times \frac{9}{5} \leftarrow \text{Write mixed numbers as improper fractions first.} \\ &= \frac{63}{15} \\ &= \frac{21}{5} \text{ or } 4\frac{1}{5} \end{aligned}$$

Two numbers whose product is 1 are called **reciprocals**.

Since $\frac{3}{5} \times \frac{5}{3} = \frac{15}{15}$ or 1, $\frac{3}{5}$ and $\frac{5}{3}$ are reciprocals.

Express all answers in lowest terms.

Multiply.

1. $\frac{1}{2} \times \frac{1}{4}$ _____ 2. $\frac{2}{3} \times \frac{1}{5}$ _____

3. $\frac{3}{4} \times \frac{4}{5}$ _____ 4. $\frac{7}{10} \times \frac{2}{3}$ _____

5. $\frac{1}{6} \times \frac{3}{8}$ _____ 6. $\frac{2}{7} \times \frac{1}{2}$ _____

Calculate.

7. $\frac{1}{3}$ of 9 _____ 8. $\frac{3}{8}$ of 12 _____

9. $\frac{1}{10}$ of $\frac{4}{5}$ _____ 10. $\frac{3}{5}$ of $\frac{2}{3}$ _____

Estimate, then multiply.

11. $4 \times 1\frac{1}{8}$ _____ 12. $2 \times 2\frac{1}{4}$ _____

13. $5 \times 2\frac{1}{2}$ _____ 14. $4 \times 1\frac{3}{4}$ _____

15. $1\frac{3}{4} \times 2\frac{2}{3}$ _____ 16. $3\frac{1}{8} \times 1\frac{1}{6}$ _____

17. $4\frac{2}{5} \times 2\frac{3}{10}$ _____ 18. $2\frac{1}{2} \times 5\frac{5}{9}$ _____

19. $1\frac{3}{7} \times 3\frac{5}{6}$ _____ 20. $3\frac{1}{2} \times 3\frac{1}{2}$ _____

Multiply.

21. $\frac{2}{3} \times 3 \times \frac{1}{8}$ _____

22. $\frac{1}{2} \times 4 \times \frac{4}{5}$ _____

23. $1\frac{1}{7} \times 2\frac{1}{2} \times 1\frac{7}{8}$ _____

24. $7 \times 3\frac{2}{3} \times 1\frac{1}{4}$ _____

Write the reciprocal.

25. $\frac{3}{4}$ _____ 26. $\frac{3}{2}$ _____

27. $\frac{2}{7}$ _____ 28. $2\frac{1}{6}$ _____

29. $3\frac{2}{7}$ _____ 30. $4\frac{1}{4}$ _____

Find the missing value.

31. $\frac{4}{5} \times 1\frac{1}{4} = \square$ 32. $1 = \frac{3}{4} \times \square$

33. $\square \times 3\frac{1}{2} = 1$ 34. $8 \times \square = 1$

35. $\frac{3}{4} \times \square = \frac{2}{3} \times 1\frac{1}{2}$

36. $4 \times \frac{1}{4} = \square \times 6$

2.6 Dividing Fractions

MATHPOWER™ *Eight*, pp. 58–59

To divide by a fraction, multiply by its reciprocal.

$$\begin{aligned}
 3\frac{1}{2} \div 1\frac{2}{3} &= \frac{7}{2} \div \frac{5}{3} && \leftarrow \text{Write the mixed numbers as improper fractions,} \\
 &= \frac{7}{2} \times \frac{3}{5} && \text{then divide.} \\
 &= \frac{21}{10} \text{ or } 2\frac{1}{10}
 \end{aligned}$$

Express all answers in lowest terms.

Divide.

1. $\frac{2}{3} \div \frac{1}{5}$ _____ 2. $\frac{2}{5} \div \frac{1}{3}$ _____

3. $\frac{1}{2} \div \frac{1}{6}$ _____ 4. $\frac{3}{4} \div \frac{1}{2}$ _____

Divide.

5. $5 \div \frac{1}{4}$ _____ 6. $4 \div \frac{2}{3}$ _____

7. $\frac{1}{2} \div 3$ _____ 8. $\frac{1}{2} \div 7$ _____

Divide.

9. $1\frac{2}{5} \div \frac{5}{9}$ _____ 10. $3\frac{2}{3} \div \frac{1}{7}$ _____

11. $2\frac{1}{2} \div \frac{4}{11}$ _____ 12. $4\frac{1}{3} \div \frac{2}{5}$ _____

13. $\frac{7}{12} \div 3\frac{1}{2}$ _____ 14. $\frac{7}{15} \div 2\frac{2}{3}$ _____

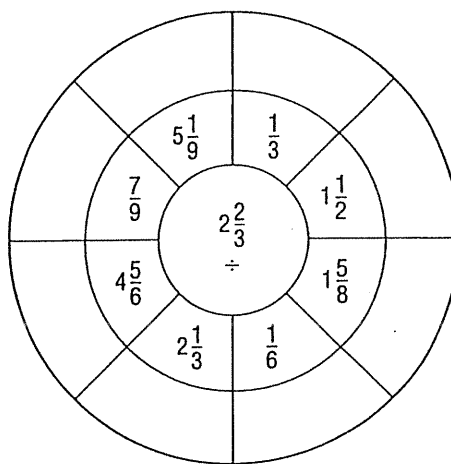
15. $\frac{1}{3} \div 1\frac{1}{4}$ _____ 16. $\frac{6}{7} \div 4\frac{3}{4}$ _____

17. $1\frac{3}{8} \div 1\frac{3}{4}$ _____ 18. $3\frac{1}{6} \div 1\frac{5}{6}$ _____

19. $2\frac{5}{12} \div 1\frac{1}{3}$ _____ 20. $4\frac{3}{7} \div 1\frac{3}{8}$ _____

21. $6 \div 2\frac{3}{4}$ _____ 22. $9 \div 4\frac{1}{5}$ _____

23. Complete the division wheel.



24. A juice jug holds $3\frac{3}{4}$ L of juice. How many glasses of juice can you pour if each one holds $\frac{1}{5}$ L?

Calculate the average speed for each of the following.

25. 126 km in $2\frac{1}{4}$ h _____

26. $292\frac{1}{2}$ km in $4\frac{1}{2}$ h _____

27. 288 km in $3\frac{3}{5}$ h _____

Find the missing value.

28. $\frac{2}{15} \div \square = \frac{2}{3}$ 29. $\frac{5}{8} \div \square = 1\frac{2}{3}$

30. $\square \div 1\frac{5}{7} = \frac{3}{4}$ 31. $\square \div 2\frac{1}{4} = 1\frac{1}{5}$

Dividing Fractions Word Problems Worksheet

Multiple Choice

Identify the choice that best completes the statement or answers the question.

- _____ 1. Paige spends equal amounts of time on the homework of each subject. She spends altogether 1 h on her homework. If Paige spends $\frac{1}{4}$ h on French, how many subjects does she study?
a. 3 subjects b. 5 subjects c. 6 subjects d. 4 subjects
- _____ 2. Brenda has $\frac{5}{6}$ of a pie to divide evenly among 4 people. What fraction of a pie does each person get?
a. $\frac{3}{10}$ b. $\frac{1}{4}$ c. $\frac{5}{24}$ d. $\frac{1}{6}$
- _____ 3. Steve's home is 3 km from school. This is $\frac{1}{3}$ the distance Mike's home is from school. How far is Mike's home from school?
a. 9 km b. 1 km c. $3\frac{1}{3}$ km d. $2\frac{2}{3}$ km
- _____ 4. You have $2\frac{2}{3}$ cups of dried fruit to divide evenly among 5 children. How many cups of fruit will each child receive?
a. $\frac{15}{8}$ b. $\frac{8}{15}$ c. $\frac{7}{15}$ d. $\frac{15}{7}$
- _____ 5. Jay needs $1\frac{1}{4}$ cups of flour for a batch of cookies. How many batches can he make with 12 cups of flour?
a. 9 batches b. 10 batches c. 8 batches d. 6 batches
- _____ 6. Melanie has a piece of cloth that is $4\frac{1}{4}$ m long. How many $\frac{1}{2}$ -m pieces can be cut from the cloth?
a. 9 pieces b. 4 pieces c. 7 pieces d. 8 pieces

Short Answer

7. It takes half an hour to construct a box. How many boxes can be made in 12 h?
8. A juice bottle holds $\frac{3}{5}$ L of juice. How many bottles can be filled from a tank containing 12 L of juice?

9. How many $\frac{3}{4}$ -m pieces of ribbon can be cut from a roll of ribbon that is 60 m long?

10. A rope is $\frac{19}{24}$ -m long. How many $\frac{1}{6}$ m pieces can be cut from this rope?

11. Dorina can ice a cake in $\frac{1}{6}$ h. How many cakes can she ice in $\frac{5}{6}$ h?

12. It takes Rhonda $13\frac{1}{2}$ h to build a model. She worked on her model for $2\frac{1}{4}$ h each evening.
How many evenings does it take her to finish her model?

13. A recipe for chocolate chip cookies calls for $1\frac{1}{4}$ cups of chocolate chips.
If Eileen has $5\frac{5}{8}$ cups of chips, how many batches of cookies can she make?

14. A piece of ribbon is $33\frac{1}{4}$ m long. How many $2\frac{3}{8}$ -m pieces can be cut from this length of ribbon?

Problem

15. Jolene has 2 cats. Each day, she feeds one cat $\frac{1}{5}$ of a tin and the other cat $\frac{1}{4}$ of a tin of cat food.
- How much cat food does Jolene need for her cats each day?
 - How many days can 18 tins of cat food last?
16. Jack has 5 dogs and each dog gets $\frac{1}{4}$ kg of food each day.
- If Jack has $8\frac{3}{4}$ kg of dog food, how long can it last?
17. Three students have to each conduct an experiment that requires $\frac{1}{3}$ cup of concentrate.
- The teacher has $\frac{3}{4}$ cup of concentrate. Is there enough concentrate for each student to complete the experiment? Explain.
18. In a cross-country training circuit, Ross completed $5\frac{1}{4}$ laps in $39\frac{3}{8}$ minutes.
- If he completed each lap in the same time, how long did it take him to complete each lap?
19. A rectangle has an area of $1\frac{19}{21}$ cm² and a length of $1\frac{3}{7}$ cm.
- What is the width of the rectangle?
 - What is the perimeter of the rectangle?

Dividing Fractions Word Problems

Answer Section

MULTIPLE CHOICE

1. D
2. C
3. A
4. B
5. A
6. D

SHORT ANSWER

7. 24 boxes
8. 20 bottles
9. 80 pieces
10. $4\frac{3}{4}$ pieces
11. 5 cakes
12. 6 evenings
13. $4\frac{1}{2}$ batches
14. 14

PROBLEM

15. a) Jolene needs $\frac{9}{20}$ tins of cat food each day.
b) So, 18 tins of cat food can last 40 days.
16. Jack needs $1\frac{1}{4}$ kg of dog food each day.
To find the number of the days the dog food can last, divide.
The dog food can last 7 days.
17. There is only enough for 2 students, so one student will not be able to conduct the experiment.
18. It took Ross $7\frac{1}{2}$ min to complete each lap.
19. a) The width of the rectangle is $1\frac{1}{3}$ cm.
b) So, the perimeter of the rectangle is $5\frac{11}{21}$ cm.

• **Number (Operations)**

I.1 adds and subtracts fractions concretely, pictorially, and symbolically – *continued*

— estimates, computes and verifies sums and differences of rational numbers, using only decimal representations of negative rationals) – *continued (N-V.1.8)*

◆ solves problems involving addition and subtraction of fractions

◆ estimates, computes, and verifies sums and differences of rational numbers

1. "Eric ordered several large pizzas for a party. One and one-half pepperoni pizzas and two-thirds of a pineapple pizza were eaten. Was there more than 1 large pizza left over? Explain how to estimate the answer. Use illustrations to show how you can solve the problem."
2. "Mr. Blair's gas tank was seven-eighths full when he left home. He used three-fourths of a tank of gas on his errands. What fraction of a tank of gas was left? Show how you got your answer."
3. "Mrs. Curyk's recipe called for $\frac{1}{2}$ litre oil and $\frac{3}{4}$ litre milk. How much liquid did she use altogether? Explain how you can solve this problem mentally in 2 different ways."
4. A farmer has 8 fields of equal size. He plants 4 fields with wheat and 2 fields with barley. Write fractions in 2 different ways to represent the wheat and barley fields. What fraction of the fields has neither wheat nor barley?
5. Andrea ordered several large pizzas for the class party. They found that seven-eighths of a pepperoni pizza and three-fourths of a vegetarian pizza were left over. What is the total amount not eaten? Verify your calculator answer by adding the fractions using paper and pencil and then converting the answer to a decimal number.

6. Pam recorded the daily high temperatures for 1 week and found the average high temperature for the week to be -4.1°C . If the temperatures from Sunday to Friday were 11.7°C , -17.4°C , 0°C , -23.6°C , 13.9°C , and 9.1°C , what was the temperature on Saturday? Explain how you would estimate the answer. Estimate it, then calculate the answer and compare it with your estimate.

7. What is the difference in temperature between Vancouver at 5.4°C and Winnipeg at -25°C ?
Mount Everest is 8 850 m above sea level. The Jean Bernardin cave in France is 10 344 m lower than Mt. Everest. How many metres below sea level is the cave?

8. It snowed for $3\frac{1}{2}$ hours on Monday, $2\frac{3}{4}$ hours on Tuesday, and $1\frac{4}{5}$ hours on Wednesday. Find the mean snowfall duration over the three-day period.

9. Doctors recommend that people spend 20 minutes per day exercising. Sarah kept track of the time she spent exercising over three days. The chart shows her results.

Type of Exercise	Total Time Spent (min)
Sit-ups	$12\frac{1}{2}$ min
Chin-ups	$10\frac{1}{2}$ min
Running on the spot	$15\frac{1}{3}$ min

- (a) Determine the mean number of minutes per day Sarah spent exercising.
(b) By how many minutes must she increase her mean time to meet the recommended requirement?