

13. [Rates / Ratios]

Skill 13.1 Simplifying ratios with two numbers.

MMBlue 11 22 33 44
MMGreen 11 22 33 44

The ratio sign, a colon “ : ” means “is to”. To simplify a ratio, find the highest number (Greatest Common Factor) that divides exactly into each part of the ratio.

Q. Simplify 16 : 12

$$\begin{aligned} \text{A. } & 16 : 12 \\ & \overset{4}{\cancel{16}} : \overset{3}{\cancel{12}} \\ & = 4 : 3 \end{aligned}$$

The highest number that divides into 16 and 12 (GCF) is 4.

$$\begin{aligned} 16 \div 4 &= 4 \\ 12 \div 4 &= 3 \end{aligned}$$

OR

You can first divide by 2 and then divide the results by 2 again.

a) Simplify 21 : 3

$$\begin{aligned} \overset{7}{\cancel{21}} : \overset{1}{\cancel{3}} &= 7 : 1 \\ (\div 3) & \end{aligned}$$

b) Simplify 5 : 30

$$\begin{aligned} 5 : 30 &= \quad : \quad \\ (\div 5) & \end{aligned}$$

c) Simplify 6 : 48

$$\quad : \quad$$

d) Simplify 40 : 60

$$\quad : \quad$$

e) Simplify 12 : 18

$$\quad : \quad$$

f) Simplify 100 : 20

$$\quad : \quad$$

g) Simplify 15 : 10

$$\quad : \quad$$

h) Simplify 24 : 16

$$\quad : \quad$$

i) Simplify 25 : 300

$$\quad : \quad$$

j) Simplify 25 : 80

$$\quad : \quad$$

k) Simplify 150 : 500

$$\quad : \quad$$

l) Simplify 75 : 20

$$\quad : \quad$$

m) Simplify 49 : 21

$$\quad : \quad$$

n) Simplify 15 : 75

$$\quad : \quad$$

o) Simplify 12 : 30

$$\quad : \quad$$

Q. Simplify \$150 : \$400

A. $\$150 : \400
 $= \overset{3}{150} : \overset{8}{400}$
 $= 3 : 8$

Ignore the \$ sign. The numbers can be simplified.
 The highest number that divides into 150 and 400
 (GCF) is 50. $150 \div 50 = 3$
 $400 \div 50 = 8$

OR
 If it is easier, first divide by 10 and then by 5.

a) Simplify 30 kg : 6 kg

$\overset{5}{30} \text{ kg} : \overset{1}{6} \text{ kg} = 5 : 1$

 ($\div 6$)

b) Simplify 90 mm : 30 mm

$90 \text{ mm} : 30 \text{ mm} = \quad : \quad$

 ($\div 30$)

c) Simplify 12 cm : 48 cm

$\quad : \quad$

d) Simplify 15 kg : 12 kg

$\quad : \quad$

e) Simplify 50 km : 60 km

$\quad : \quad$

f) Simplify 32 L : 20 L

$\quad : \quad$

g) Simplify 75 g : 35 g

$\quad : \quad$

h) Simplify 150 mL : 250 mL

$\quad : \quad$

i) Simplify 48 m : 28 m

$\quad : \quad$

j) Simplify 95 g : 45 g

$\quad : \quad$

k) Simplify 180 mL : 150 mL

$\quad : \quad$

l) Simplify 68 m : 18 m

$\quad : \quad$

m) Simplify 85 g : 25 g

$\quad : \quad$

n) Simplify 140 mL : 120 mL

$\quad : \quad$

o) Simplify 28 m : 8 m

$\quad : \quad$

Q. A plumber charges \$140 to complete two hours work. What is her pay per hour?

A. $Rate = \frac{payment}{time}$
 $= \frac{140}{2}$
 $= \$70 \text{ per hour}$

OR $\div 2 \left(\begin{array}{l} \$140 \text{ for } 2 \text{ h} \\ \$70 \text{ for } 1 \text{ h} \end{array} \right) \div 2$

Q. Water is released from a dam at a constant rate of 20,000 L per hour. How many liters are released in 4 hours?

A. $Quantity = rate \times time$
 $= 20,000 \text{ L/h} \times 4 \text{ h}$
 $= 80,000 \text{ L}$

OR $\times 4 \left(\begin{array}{l} 20,000 \text{ L in } 1 \text{ h} \\ 80,000 \text{ L in } 4 \text{ h} \end{array} \right) \times 4$

a) Leo works 40 hours a week in a factory and earns \$440 per week. What are his earnings per hour?

$440 \div 40 = \$11 \text{ per hour}$

b) A 25 minute telephone call to London costs \$3.00. What is the cost in cents per minute?

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c) A tap drips at a rate of 20 mL per hour. How much water is wasted in two days?

.....

d) Susie can type 30 words per minute. At this rate, how many words can she type in one and a half hours?

.....

e) Bicycling burns 11 calories per minute. How many calories would you burn if you cycle for forty minutes?

.....

f) Linda spoke at a conference at a rate of 35 words per minute. How many words were spoken in her 10 minute speech?

.....

g) If scalpal hair grows at the rate of 1.25 cm per month, how many centimeters would scalpal hair grow in a year?

.....

h) In a 30 hour week Yang's mother earns \$540. What is her hourly pay rate?

.....

Q. Simplify 18 : 12 : 36

$$\begin{aligned} \text{A. } & 18 : 12 : 36 \\ & = \overset{3}{\cancel{18}} : \overset{2}{\cancel{12}} : \overset{6}{\cancel{36}} \\ & = 3 : 2 : 6 \end{aligned}$$

Simplify each number. Divide by the GCF of 18, 12 and 36, which is 6.

$$18 \div 6 = 3$$

$$12 \div 6 = 2$$

$$36 \div 6 = 6$$

OR

If it is easier, first divide by 2 and then by 3.

a) Simplify 15 : 10 : 5

$$\begin{aligned} \overset{3}{\cancel{15}} : \overset{2}{\cancel{10}} : \overset{1}{\cancel{5}} &= 3 : 2 : 1 \\ (\div 5) & \end{aligned}$$

b) Simplify 4 : 16 : 24

$$\begin{aligned} 4 : 16 : 24 &= : : \\ (\div 4) & \end{aligned}$$

c) Simplify 20 : 30 : 10

$$: : :$$

d) Simplify 9 : 3 : 6

$$: : :$$

e) Simplify 12 : 10 : 14

$$: : :$$

f) Simplify 21 : 14 : 42

$$: : :$$

g) Simplify 15 : 10 : 25

$$: : :$$

h) Simplify 6 : 18 : 21

$$: : :$$

i) Simplify 40 : 12 : 36

$$: : :$$

j) Simplify 32 : 40 : 16

$$: : :$$

k) Simplify 27 : 18 : 9

$$: : :$$

l) Simplify 30 : 12 : 24

$$: : :$$

m) Simplify 42 : 30 : 14

$$: : :$$

n) Simplify 38 : 12 : 6

$$: : :$$

o) Simplify 40 : 18 : 34

$$: : :$$

p) Simplify 12 : 18 : 30

$$: : :$$

q) Simplify 32 : 20 : 8

$$: : :$$

r) Simplify 36 : 18 : 81

$$: : :$$

<p>Q. From a 30 lb marble block, Jo made an 18 lb statue. Find the ratio of the statue's weight to the wasted marble.</p>	<p>A. Statue's weight 'is to' wasted marble $= 18 : ?$ $= 18 : 12$ $= \overset{3}{\cancel{18}} : \overset{2}{\cancel{12}}$ $= 3 : 2$</p> <p>First write the ratio in words. This helps with the order of the ratio, which matters. Then put numbers to what you know. E.g. The statue's weight is 18 lb. Find the amount of wasted marble, by subtracting the weight of the statue from the original block of marble: $30 \text{ lb} - 18 \text{ lb} = 12 \text{ lb}$</p> <p>Simplify the ratio by dividing 18 and 12 by their GCF, which is 6.</p>
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<p>Q. The ratio of weight on Earth to weight on Jupiter is 2:5. What would a 120 lb astronaut weigh on Jupiter?</p>	<p>A. Weight on Earth 'is to' weight on Jupiter $= 2 : 5$ $= 120 : ?$ $= 120 : 300$</p> <p>$\times 60$ Write what is given in words, then use numbers. Check if you need to multiply or divide to get from one ratio to the next. Keep any changes to each side of the ratio the same.</p> <p>A 120 lb astronaut is 60 times bigger than 2 lb, so multiply 5 by 60. A 120 lb astronaut would weigh 300 lb on Jupiter.</p>
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a) There are three horses in a paddock. Find the ratio of the total number of legs to the total number of ears.
legs to ears = $\overset{2}{\cancel{12}} : \overset{1}{\cancel{6}} = 2 : 1$

b) Of the 100 athletes in the Olympic team, 15 are gymnasts. Find the ratio of gymnasts to other members of the team.

c) Plasma, a component of human blood, is 90% water and 10% dissolved solutes. Write the ratio of water to solutes in plasma.

d) Every 100 g of chocolate bar contains 28 g of fat. Find the ratio of fat to other substances.

e) What is the ratio of the number of grams in a kilogram to the number of kilograms in a tonne?

f) The soft drink is 25% lemon juice and the rest is water. Find the ratio of lemon juice to water.

g) A school has 25 teachers and 400 students. What is the student to teacher ratio?

h) The ratio of weight on Earth to weight on Pluto is 20:1. What would an 80 kg astronaut weigh on Pluto?

Skill 13.6 Calculating the average speed.

Speed is the rate at which an object moves: the distance traveled in a unit of time. Speed is worked out by dividing the distance traveled by the time taken. We call this the average speed:

$$\text{Average speed} = \frac{\text{distance traveled}}{\text{time taken}} \quad \leftarrow \text{this line is telling you to divide}$$

Q. Find the average speed of a car which travels 150 miles in 3 hours.

A. $Speed = \frac{distance}{time}$
 $= \frac{150}{3}$
 $= 150 \div 3$
 $= 50 \text{ miles per hour (or mph)}$

a) A cyclist rides 30 miles in 2 hours. Find her average speed.

$$Speed = \frac{distance}{time} = \frac{30}{2} = 15 \text{ mph}$$

.....

b) A Concorde flew the 3660 miles from Paris to New York in 3 hours. Find its average speed.

mph

.....

c) A dolphin can swim up to 130 km in 2 hours. Find its average speed.

km/h

.....

d) A Formula 1 driver covered 300 km in one and a half hours. What was his average speed?

km/h

.....

e) A train takes 3 hours to travel 141 miles. What is its average speed in miles per hour?

mph

.....

f) A truck driver traveled 236 miles in 4 hours. Find the truck's average speed in miles per hour.

mph

.....

g) A penguin can swim up to 2 km in half an hour. Find its average speed in km/h.

km/h

.....

h) A giraffe can run up to 25 km in half an hour. What is its average speed in km/h?

km/h

.....

Distance traveled = average speed \times time taken

Q. Trent rides his bike for 2 hours at an average speed of 12 miles per hour. How far did he travel?

A. $Distance = speed \times time$
 $= 12 \text{ mph} \times 2 \text{ h}$
 $= 12 \times 2$
 $= 24 \text{ miles}$

a) A plane travels for 8 hours at an average speed of 560 miles per hour. Find the distance covered by the plane.

$Distance = 560 \times 8 = 4480$ miles

b) The Golden eagle can fly at a speed of 300 km/h. What distance can it fly in half an hour at this speed?

..... km

c) A jet flies at an average speed of 470 mph from Melbourne to Singapore. How far away is Singapore, if the flight takes 8 hours?

..... miles

d) An athlete runs at an average speed of 6 miles per hour. What distance does he cover in a quarter of an hour?

..... miles

e) What is the distance from Sydney to Los Angeles if it takes 14 hours to fly the distance at an average speed of 600 mph?

..... miles

f) The fastest helicopter in the world is the “Westland Lynx”, which can fly at a speed of 400 km/h. What distance can it fly in half an hour?

..... km

g) Luis drives at 60 miles per hour. What distance would he cover in three and a half hours?

..... miles

h) Josh rides a jet ski at 55 km/h. What distance would he cover in two hours?

..... km

Q. Simplify $75c : \$2.00$

A. $75c : \$2.00$
 $= 75c : 200c$
 $= \overset{3}{\cancel{75}}c : \overset{8}{\cancel{200}}c$
 $= 3 : 8$

Two quantities cannot be compared unless they are expressed in the same unit, so change \$2.00 into cents.

$$\$2.00 = 2 \times 100c = 200c$$

Simplify by dividing 75 and 200 by their GCF which is 25.

$$200 \div 25 = 8$$

$$75 \div 25 = 3$$

a) Simplify $\$2.00 : 50c$

$$\overset{4}{\cancel{200}}c : \overset{1}{\cancel{50}}c = 4 : 1$$

($\div 50$)

b) Simplify $90c : \$3.00$

$$90c : 300c = \quad :$$

($\div 30$)

c) Simplify $250c : \$1.00$

$$\quad :$$

d) Simplify $25c : \$4.00$

$$\quad :$$

e) Simplify $\$4.00 : 80c$

$$\quad :$$

f) Simplify $50c : \$3.00$

$$\quad :$$

g) Simplify $150c : \$2.00$

$$\quad :$$

h) Simplify $40c : \$6.00$

$$\quad :$$

i) Simplify $\$8.00 : 40c$

$$\quad :$$

j) Simplify $50c : \$6.00$

$$\quad :$$

k) Simplify $150c : \$3.00$

$$\quad :$$

l) Simplify $60c : \$8.00$

$$\quad :$$

m) Simplify $\$7.00 : 30c$

$$\quad :$$

n) Simplify $80c : \$6.00$

$$\quad :$$

o) Simplify $150c : \$5.00$

$$\quad :$$