14. [Rates / Ratios]

EITHER
- Find the largest number that divides evenly into each number of the ratio (Greatest Common Factor).
- Divide each number by the GCF.

Hint: ':' means fraction and is read as 'to'.

$a : b = \dfrac{a}{b}$ — Ratio

OR
- Divide each number of the ratio by any factor until the ratio is reduced to simplest form.

Q. Simplify the ratio $32 : 56$

A. $32 : 56$ — GCF of 32 and 56 is 8 so ÷ 8

$\div 8 \;(\; 4 \quad 7 \;)\div 8$

$= 32 : 56$

$= \mathbf{4 : 7}$

OR A. $32 : 56$ — Simplify: ÷ 2

$\div 2 \;(\; 16 \quad 28 \;)\div 2$

$= 32 : 56$

$= 16 : 28$ — Simplify: ÷ 2

$\div 2 \;(\; 8 \quad 14 \;)\div 2$

$= 16 : 28$

$= 8 : 14$ — Simplify: ÷ 2

$\div 2 \;(\; 4 \quad 7 \;)\div 2$

$= 8 : 14$

$= \mathbf{4 : 7}$

---

a) Simplify the ratio $4 : 6$

$= 4 : 6$ — Simplify: ÷ 2 $= \boxed{2 : 3}$

b) Simplify the ratio $6 : 12$

$= 6 : 12$ — Simplify: ÷ 6 $= \boxed{\quad : \quad}$

c) Simplify the ratio $30 : 50$

$=$ $= \boxed{\quad : \quad}$

d) Simplify the ratio $10 : 15$

$=$ $= \boxed{\quad : \quad}$

e) Simplify the ratio $45 : 15$

$= 45 : 15$ — Simplify: ÷ 15 $= \boxed{\quad : \quad}$

f) Simplify the ratio $18 : 24$

$=$ $= \boxed{\quad : \quad}$

g) Simplify the ratio $100 : 70$

$=$ $= \boxed{\quad : \quad}$

h) Simplify the ratio $32 : 8$

$=$ $= \boxed{\quad : \quad}$

i) Simplify the ratio $24 : 96$

$=$ $= \boxed{\quad : \quad}$

j) Simplify the ratio $30 : 54$

$=$ $= \boxed{\quad : \quad}$

k) Simplify the ratio $27 : 36$

$=$ $= \boxed{\quad : \quad}$

l) Simplify the ratio $24 : 16$

$=$ $= \boxed{\quad : \quad}$

m) Simplify the ratio $150 : 45$

$=$ $= \boxed{\quad : \quad}$

n) Simplify the ratio $90 : 240$

$=$ $= \boxed{\quad : \quad}$

- Write the quantities of the ratio with the same unit of measurement.

EITHER
- Find the largest number that divides evenly into each quantity of the ratio (Greatest Common Factor).
- Divide each quantity by the GCF.

OR
- Divide each quantity of the ratio by any factor until the ratio is reduced to simplest form.

Hints: The order of the quantities in a ratio matters.
  ':' means fraction and is read as 'to'.
Examples: The ratio of legs to ears in a cat is 4 : 2 = 2 : 1
  The ratio of ears to legs in a cat is 2 : 4 = 1 : 2

$$a : b = \frac{a}{b} \quad \text{Ratio}$$

Q. Simplify the ratio   10 oz : 2 lb

A.   *2 lb = 2 × 16 oz = 32 oz*   ⟵ *1 lb = 16 oz*

10 oz : 2 lb

$$= 10 \text{ oz} : 32 \text{ oz} \quad \text{GCF of 10 and 32}$$
$$\div 2 \underset{5}{} \quad \underset{16}{} \div 2 \quad \text{is 2 so} \div 2$$
$$= \cancel{10} \text{ oz} : \cancel{32} \text{ oz}$$

$$= \boldsymbol{5 : 16} \quad \text{Ignore the units}$$

---

a) Simplify the ratio   48 kg : 80 kg

$$= \overset{3}{\cancel{48}} : \overset{5}{\cancel{80}} \quad \text{Simplify: ÷ 16}$$

$$= \boxed{\qquad : \qquad}$$

b) Simplify the ratio   50 ft : 125 ft

$$= 50 : 125 \quad \text{Simplify: ÷ 25}$$

$$= \boxed{\qquad : \qquad}$$

c) Simplify the ratio   120 yd : 36 yd

$$= \qquad\qquad\qquad = \boxed{\qquad : \qquad}$$

d) Simplify the ratio   150 in. : 175 in.

$$= \qquad\qquad\qquad = \boxed{\qquad : \qquad}$$

e) Simplify the ratio $3.00 : 40 cents   ⟵ *$1 = 100¢*

$$\$3.00 = 3.\overset{\frown}{00} \times 100\cancel{¢} = 300\cancel{¢} \quad \text{2 zeros, 2 places right}$$

$$= \overset{15}{\cancel{300¢}} : \overset{2}{\cancel{40¢}} \quad \text{Simplify: ÷ 20} \quad = \boxed{\boldsymbol{15 : 2}}$$

f) Simplify the ratio   40 s : 2 min

$$= \qquad\qquad\qquad = \boxed{\qquad : \qquad}$$

g) Simplify the ratio   6 yd : 6 ft

$$= \qquad\qquad\qquad = \boxed{\qquad : \qquad}$$

h) Simplify the ratio $4.00 : 25 cents

$$= \qquad\qquad\qquad = \boxed{\qquad : \qquad}$$

i) Simplify the ratio   6 days : 4 weeks

$$= \qquad\qquad\qquad = \boxed{\qquad : \qquad}$$

j) Simplify the ratio   3 ft : 8 in.

$$= \qquad\qquad\qquad = \boxed{\qquad : \qquad}$$

Skill 14.3 Solving questions involving distance, time and speed (1).

$$\text{rate (speed)} = \frac{\text{distance traveled } (d)}{\text{time taken } (t)} \quad \text{OR} \quad r = \frac{d}{t}$$

$$\text{distance traveled } (d) = \text{rate } (r) \cdot \text{time taken } (t) \quad \text{OR} \quad d = rt$$

$$\text{time taken } (t) = \frac{\text{distance traveled } (d)}{\text{rate } (r)} \quad \text{OR} \quad t = \frac{d}{r}$$

- Write the formula for the rate (speed), or distance or time taken to travel.
- Convert the given units into the required units if necessary.   (see Math Facts, page 377)
  Hints: If the rate (speed) must be calculated in mph, convert the units for distance to miles and the
  units for time to hours.
  Changing from smaller units into larger units, always divide by the conversion factor.
  Changing from larger units into smaller units, always multiply by the conversion factor.
- Substitute the known values into the formula.
- Simplify and evaluate.

Q. A jet travels at an average speed of 550 mph. How long would it take to travel 2475 miles?

A. $t = \dfrac{\text{distance traveled}}{\text{rate}} = \dfrac{d}{r}$

$= \dfrac{2475 \text{ mi}}{550 \text{ mph}}$ *(Substitute into the formula)*

$= \dfrac{\overset{99}{\cancel{2475}}}{\underset{22}{\cancel{550}}}\, h$ *(Simplify: ÷ 25)*

$= \dfrac{\overset{9}{\cancel{99}}}{\underset{2}{\cancel{22}}}\, h$ *(Simplify: ÷ 11)*

$= \textbf{4.5 h}$

---

a) How far will John walk in 45 minutes if he walks at 10 km/h?

$t = 45 \ min = 0.75 \ h$ *(three quarters of an hour)*

(Use $d = rt$)

$d = 10 \ km/h \cdot 0.75 \ h \qquad = \boxed{7.5 \ \text{km}}$

b) A cyclist rides at an average speed of 18 km/h. How long would it take to travel 45 km?

(Use $t = \dfrac{d}{r}$)

$t = \dfrac{\overset{5}{\cancel{45}} \text{ km}}{\underset{2}{\cancel{18}} \text{ km/h}}$ *(Simplify: ÷ 9)*

$= \hspace{3cm} = \boxed{\hphantom{xxx} \text{h}}$

c) The X-15 rocket plane is the fastest aircraft with a maximum speed of 4520 mph, reached in 1967. At this rate how far could it travel in 5 hours?

$d =$

$= \hspace{3cm} = \boxed{\hphantom{xxx} \text{mi}}$

d) An airplane flew from Denver to New York, a distance of 1600 miles. If the plane traveled at an average speed of 500 mph, how long did the trip take?

$t =$

$= \hspace{3cm} = \boxed{\hphantom{xxx} \text{h}}$

---

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Skill 14.3 Solving questions involving distance, time and speed (2).

e) An airplane flew from Memphis to Pittsburgh, a distance of 660 miles. If the plane traveled 1.1 hours, how fast did it travel?

$r = \dfrac{d}{t} = \dfrac{^{60}\cancel{660}\ mi}{_{0.1}\cancel{1.1}\ h} = 60 \div 0.1\ mph$ *Simplify: ÷ 11*

$= 600 \div 1\ mph$ $=$ ☐ mph

f) An airplane flew from Houston to Salt Lake City, a distance of 1200 miles. If the plane traveled 2.5 hours, how fast did it travel?

$r =$

$=$ $=$ ☐ mph

g) An emu can run 9 km in 12 minutes. What is its average speed in kilometers per hour?

$r =$

$=$ $=$ ☐

h) Some species of dolphin can swim 9 miles at 36 mph. How long would it take to swim this distance?

$t =$

$=$ $=$ ☐ min

i) A train travels at an average speed of 48 mph. What distance would it travel in one hour and 15 minutes?

$d =$

$=$ $=$ ☐ mi

j) A satellite orbits the earth at an average speed of 8 km/s. What distance does it travel in 20 minutes?

$d =$

$=$ $=$ ☐ km

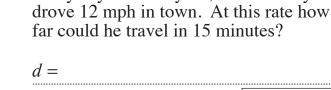**k)** How far will a salmon swim in 12 minutes if it swims at 45 km/h?

$d =$

$=$ $=$ ☐ km

l) A hot air balloon travels at a speed of 21 km/h. At this rate how far will it travel in 40 minutes?

$d =$

$=$ $=$ ☐ km

m) Earth moves around the sun at an average speed of 65,000 mph. What distance does it move in a quarter of an hour?

$d =$

$=$ $=$ ☐ mi

n) In 1904 the first speeding ticket went to Harry Myers of Dayton, Ohio. Harry drove 12 mph in town. At this rate how far could he travel in 15 minutes?

$d =$

$=$ $=$ ☐ mi

Skill 14.4   Simplifying ratios by comparing three numbers.

EITHER
- Find the largest number that divides evenly into each number of the ratio (Greatest Common Factor).
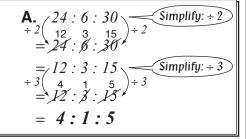- Divide each number by the GCF.

OR
- Divide each number of the ratio by any factor until the ratio is reduced to simplest form.

Q. Simplify the ratio

$24 : 6 : 30$

A. $24 : 6 : 30$ — GCF of 24, 6 and 30 is 6 so ÷ 6

$÷6 \begin{pmatrix} 4 & 1 & 5 \end{pmatrix} ÷6$

$= 24 : 6 : 30$

$= 4 : 1 : 5$

OR

A. $24 : 6 : 30$ — Simplify: ÷ 2

$÷2 \begin{pmatrix} 12 & 3 & 15 \end{pmatrix} ÷2$

$= 24 : 6 : 30$

$= 12 : 3 : 15$ — Simplify: ÷ 3

$÷3 \begin{pmatrix} 4 & 1 & 5 \end{pmatrix} ÷3$

$= 12 : 3 : 15$

$= 4 : 1 : 5$

---

a) Simplify the ratio $72 : 16 : 40$

$= 72 : 16 : 40$ — Simplify: ÷ 8
   (9   2   5)

$= \boxed{9 : 2 : 5}$

b) Simplify the ratio $4 : 8 : 16$

$= \boxed{ : : }$

c) Simplify the ratio $3 : 9 : 27$

$= \boxed{ : : }$

d) Simplify the ratio $10 : 30 : 45$

$= \boxed{ : : }$

e) Simplify the ratio $33 : 18 : 15$

$= \boxed{ : : }$

f) Simplify the ratio $18 : 36 : 27$

$= \boxed{ : : }$

g) Simplify the ratio $48 : 18 : 12$

$= \boxed{ : : }$

h) Simplify the ratio $50 : 100 : 30$

$= \boxed{ : : }$

i) Simplify the ratio $36 : 12 : 60$

$= \boxed{ : : }$

j) Simplify the ratio $30 : 45 : 90$

$= \boxed{ : : }$

k) Simplify the ratio $42 : 14 : 21$

$= \boxed{ : : }$

l) Simplify the ratio $40 : 60 : 80$

$= \boxed{ : : }$

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- Write the two ratios as equal fractions side by side.
- Cross multiply the numerators and the denominators of the fractions.
- If the two products are equal, then the two ratios are in proportion.

$A\ proportion$ $a:b = c:d$ — $2\ ratios$

$$\frac{a}{b} \diagdown \frac{c}{d}$$

$$a \cdot d = b \cdot c$$
$$ad = bc$$

Q. Which ratio forms a proportion with $\frac{5}{7}$?

A) $\frac{10}{35}$ B) $\frac{15}{14}$ C) $\frac{20}{28}$

A.

$\frac{5}{7} \diagup\!\!\!\!\diagdown \frac{10}{35}$ $\Rightarrow 5 \cdot 35 = 7 \cdot 10$
$\Rightarrow 175 = 70 \Rightarrow false$ **A**

$Cross\ multiply$

$\frac{5}{7} \diagup\!\!\!\!\diagdown \frac{15}{14}$ $\Rightarrow 5 \cdot 14 = 7 \cdot 15$
$\Rightarrow 70 = 105 \Rightarrow false$ **B**

$\frac{5}{7} \diagup\!\!\!\!\diagdown \frac{20}{28}$ $\Rightarrow 5 \cdot 28 = 7 \cdot 20$
$\Rightarrow 140 = 140 \Rightarrow$ **true**   **C**

The answer is **C**.

---

a) 5 : 12 is in proportion with 25 : 60
True or false?

$\frac{5}{12} \diagup\!\!\!\!\diagdown \frac{25}{60}$ $\Rightarrow 5 \cdot 60 = 12 \cdot 25$

$300 = 300$ $\Rightarrow$ ☐

b) 4 : 9 is in proportion with 16 : 81
True or false?

$\Rightarrow$ ☐

c) Which ratio forms a proportion with $\frac{3}{5}$?

A) $\frac{9}{25}$ B) $\frac{9}{15}$ C) $\frac{18}{25}$

A $\frac{3}{5} \diagup\!\!\!\!\diagdown \frac{9}{25}$ $\Rightarrow 3 \cdot 25 = 5 \cdot 9 \Rightarrow 75 = 45\ (F)$

B $\frac{3}{5} = \frac{9}{15}$ $\Rightarrow$

C $\Rightarrow$ $\Rightarrow$ ☐

d) Which ratio forms a proportion with $\frac{5}{6}$?

A) $\frac{10}{30}$ B) $\frac{25}{36}$ C) $\frac{35}{42}$

A $\Rightarrow$

B $\Rightarrow$

C $\Rightarrow$ $\Rightarrow$ ☐

e) Which ratio forms a proportion with $\frac{2}{7}$?

A) $\frac{8}{28}$ B) $\frac{10}{70}$ C) $\frac{4}{49}$

A $\Rightarrow$

B $\Rightarrow$

C $\Rightarrow$ $\Rightarrow$ ☐

f) Which ratio forms a proportion with $\frac{7}{9}$?

A) $\frac{21}{36}$ B) $\frac{49}{81}$ C) $\frac{35}{45}$

A $\Rightarrow$

B $\Rightarrow$

C $\Rightarrow$ $\Rightarrow$ ☐

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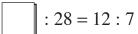
Skill 14.6 Finding the missing term in a proportion (1).

- Write the proportion as two equal fractions.
- Cross multiply the numerators and the denominators of the fractions.
- Equate the products.
- Solve the equation to find the missing number (x).

$A\ proportion$ $a:b = c:d$ $2\ ratios$

$$\frac{a}{b} \diagdown\diagup \frac{c}{d}$$

$Cross\ product$ $a \cdot d = b \cdot c$

$$ad = bc$$

Q. Complete the missing term in the proportion:

$$\boxed{} : 28 = 12 : 7$$

A. $\dfrac{x}{28} = \dfrac{12}{7}$

$$\frac{x}{28} \diagup\!\!\!\!\diagdown \frac{12}{7} \quad Cross\ multiply$$

$x \cdot 7 = 28 \cdot 12$

$7x = 28 \cdot 12$

$$\frac{{}^1\cancel{7}x}{{}_1\cancel{7}} = \frac{{}^4\cancel{28} \cdot 12}{{}_1\cancel{7}} \quad Simplify: \div 7$$

$x = 4 \cdot 12$

$x = \mathbf{48}$

a) Complete the missing term in the proportion:

$$3 : \boxed{4} = 12 : 16$$

$$\frac{3}{x} \diagup\!\!\!\!\diagdown \frac{12}{16} \qquad \Rightarrow 3 \cdot 16 = x \cdot 12$$

$$\frac{{}^1\cancel{12}x}{{}_1\cancel{12}} = \frac{{}^1\cancel{3} \cdot \cancel{16}^4}{{}_4\cancel{12}} \quad Simplify: \div 3, \div 4 \qquad \Rightarrow x = 4$$

b) Complete the missing term in the proportion:

$$24 : 15 = \boxed{} : 5$$

$$\frac{24}{15} \diagup\!\!\!\!\diagdown \frac{x}{5} \qquad \Rightarrow 24 \cdot 5 = 15 \cdot x$$

$$\frac{15x}{15} = \frac{24 \cdot 5}{15} \qquad \Rightarrow x =$$

c) Complete the missing term in the proportion:

$$3 : 10 = \boxed{} : 90$$

$$\Rightarrow$$

$$\Rightarrow x =$$

d) Complete the missing term in the proportion:

$$\boxed{} : 2 = 45 : 10$$

$$\Rightarrow$$

$$\Rightarrow x =$$

e) Complete the missing term in the proportion:

$$\frac{5}{9} = \frac{35}{\boxed{}}$$

$$\Rightarrow$$

$$\Rightarrow x =$$

f) Complete the missing term in the proportion:

$$\frac{3}{7} = \frac{18}{\boxed{}}$$

$$\Rightarrow$$

$$\Rightarrow x =$$

Skill 14.6 Finding the missing term in a proportion (2).

g) Complete the missing term in the proportion:

$$\frac{1}{7} = \frac{\boxed{}}{56}$$

$\Rightarrow$

....

$\Rightarrow x =$

....

h) Complete the missing term in the proportion:

$$\frac{7}{20} = \frac{\boxed{}}{140}$$

$\Rightarrow$

....

$\Rightarrow x =$

....

i) Complete the missing term in the proportion:

$$\frac{24}{40} = \frac{3}{\boxed{}}$$

$\Rightarrow$

....

$\Rightarrow x =$

....

j) Complete the missing term in the proportion:

$$\frac{20}{15} = \frac{4}{\boxed{}}$$

$\Rightarrow$

....

$\Rightarrow x =$

....

k) Complete the missing term in the proportion:

$$\frac{10}{45} = \frac{\boxed{}}{9}$$

$\Rightarrow$

....

$\Rightarrow x =$

....

l) Complete the missing term in the proportion:

$$\frac{64}{80} = \frac{\boxed{}}{10}$$

$\Rightarrow$

....

$\Rightarrow x =$

....

m) Complete the missing term in the proportion:

$$\frac{24}{15} = \frac{\boxed{}}{5}$$

$\Rightarrow$

....

$\Rightarrow x =$

....

n) Complete the missing term in the proportion:

$$\frac{11}{5} = \frac{\boxed{}}{15}$$

$\Rightarrow$

....

$\Rightarrow x =$

....

Skill 14.7 Solving word problems involving proportions (1).

To decide which deal is cheaper:

EITHER
- Find the unit price for each case, by dividing the cost price by the number of units.
- Compare the results.

OR
- Use any other method to make the cost price the same or the number the units the same for both deals.

To solve word problems involving proportions:

EITHER
- Find the unit rate, by dividing the amount by the given number of units.
- Multiply the unit rate by the required number of units.

OR
- Write a proportion using words.
- Replace the words with numbers:
  First the given ratio.
  Then the ratio of the given quantity to the unknown quantity.
- Find the missing term of the proportion. (see skill 14.6, page 109)

Q. Which is cheaper per soda can?
A) $2.50 for a 6-pack
B) $6 for a 12-pack

A. *Deal A)*

$$\frac{\$2.50}{6 \; cans} \overset{\div 6}{\underset{\div 6}{=}} \frac{\$0.42}{1 \; can}$$

$\Rightarrow$ *unit price = $0.42*

Deal B)

$$\frac{\$6.00}{12 \; cans} \overset{\div 12}{\underset{\div 12}{=}} \frac{\$0.50}{1 \; can}$$

$\Rightarrow$ *unit price = $0.50*

*Deal **A)** is cheaper.*

OR **A.** *Make the same number of cans:*

*Deal A) double the quantity $\Rightarrow$
double the cost*
*$2.50 for 6 cans $\Rightarrow$
$5.00 for 12 cans*

Deal B)
$6.00 for 12 cans $\Rightarrow$

*Deal **A)** is cheaper.*

---

a) There are 110 calories in 50 g of white bread. How many calories in 80 g?

calories : bread = calories : bread
110 : 50 = x : 80

$$\frac{110}{50} \diagdown \frac{x}{80} \Rightarrow 110 \cdot 80 = 50 \cdot x$$

$$x = \frac{11\cancel{0} \cdot \overset{16}{\cancel{80}}}{\underset{1}{\cancel{50}}} \qquad x = \boxed{176 \; \text{cal}}$$

b) If 5 yd of curtain material costs $65, how much would 9 yd cost?

yd : dollars = yd : dollars

$\Rightarrow$

$x =$ $\qquad$ $x = \boxed{\$ \qquad}$

---

c) If 80 concert tickets cost $360, how much would 30 tickets cost?

80 tickets for $360

$\Rightarrow$ *10 tickets for $360 ÷ 8 = $45*

$\Rightarrow$ *30 tickets for $45 × 3 =* $\boxed{\$ \qquad}$

d) If 9 pens cost $22.50, how much would 6 pens cost?

9 pens for $22.50

$\Rightarrow$

$\Rightarrow$ $\qquad = \boxed{\$ \qquad}$

Skill 14.7 Solving word problems involving proportions (2).

e) There are 300 calories in 4 oz of pork chops. How many calories in 10 oz?

4 oz have 300 cal

⇒ *2 oz*

⇒ *10 oz* = | cal |

f) If 10 lb of minced beef costs $35, how much would 6 lb cost?

10 lb for

⇒ *2 lb*

⇒ = | $ |

g) If a car travels 180 miles on 8 gallons, how far does it travel on 12 gallons at the same rate?

⇒

⇒ = | mi |

h) There are 240 calories in 5 oz of fillet steak. How many calories in 8 oz?

⇒

⇒ = | cal |

i) Which is cheaper per card?
A) $4 for 12 cards
B) $6 for 15 cards

Make the same cost

× 3
A) $4 for 12 cards ⇒ $12 for 36 cards

× 2
B) $6 for 15 cards ⇒ $12 for 30 cards ⇒ | **A** |

j) Which is cheaper per pen?
A) $4 for 6 pens
B) $5 for 8 pens

Make the same cost

A)

B) ⇒ | |

k) Which is cheaper per ounce?
A) $20 for 10 oz
B) $40 for 22 oz

A)

B) ⇒ | |

l) Which is cheaper per ounce?
A) $16 for 15 oz
B) $27 for 25 oz

A)

B) ⇒ | |

m) Which is cheaper per apple?
A) $4.80 for 4 apples
B) $6.50 for 6 apples

A)

B) ⇒ | |

n) Which is cheaper per yard?
A) $25 for 12 yards
B) $40 for 17 yards

A)

B) ⇒ | |

Skill 14.8   Finding the ratio of two quantities (1).

- Write the ratio in words.
- Replace the words with numbers.
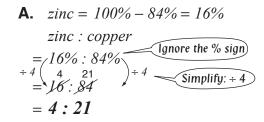- Simplify the ratio:

EITHER
- Find the largest number that divides evenly into each quantity of the ratio (Greatest Common Factor) and divide each quantity by the GCF.

  Hint: The order of the quantities in a ratio matters.

OR
- Divide each quantity of the ratio by any factor until the ratio is reduced to simplest form.

Q. The common metal for medals is 84% copper, and the rest is zinc. Find the ratio of zinc to copper.

A. *zinc = 100% − 84% = 16%*

zinc : copper

$= 16\% : 84\%$ *Ignore the % sign*

$÷4 \left(\begin{array}{cc} 4 & 21 \end{array} \right) ÷4$

$= 16 : 84$ *Simplify: ÷ 4*

$= \boldsymbol{4 : 21}$

---

a) The length of the school year in Egypt is 36 weeks and in Indonesia is 44 weeks. Find the ratio of the length of the school year duration in Indonesia compared to Egypt.

Indonesia : Egypt

$44 : 36$ *Simplify: ÷ 4*

$÷4 \left(\begin{array}{cc} 11 & 9 \end{array} \right) ÷4$

$= 44 : 36$

$= \boxed{11 : 9}$

b) A computer screen with a diagonal of 24 inches has a length of 20 inches. Find the ratio of the length to the diagonal.

length : diagonal

$20 : 24$

$= \boxed{\quad : \quad}$

c) The platinum alloy commonly used in the USA is 90% platinum and 10% iridium. Find the ratio of iridium to platinum in the alloy.

iridium : platinum

$\quad : \quad$

$= \boxed{\quad : \quad}$

d) In 1978 only 8% of U.S. households had microwave ovens. As of 2006 over 80% have them. Find the ratio of microwave oven ownership in 2006 to 1978.

$\quad : \quad$

$\quad : \quad$

$= \boxed{\quad : \quad}$

e) The 8-carat gold is 33% gold, 20% silver and the rest is copper. Find the ratio of silver to other components.

$\quad : \quad$

$\quad : \quad$

$= \boxed{\quad : \quad}$

f) For children aged 2 to 11 years, an airfare is 75% of the full adult airfare. Find the ratio of child to adult airfares.

$\quad : \quad$

$\quad : \quad$

$= \boxed{\quad : \quad}$

Skill 14.8 Finding the ratio of two quantities (2).

g) The Southern Star Observation Wheel (Melbourne) has a capacity of 20 passengers per capsule and the London Eye has a capacity of 25. Find the ratio of the London Eye passengers per capsule to the Southern Star.

$$= \frac{\quad:\quad}{\quad} = \boxed{\quad:\quad}$$

h) The London Eye has 32 capsules and the Singapore Flyer observation wheel has 28 capsules. Find the ratio of capsules in the Singapore Flyer to capsules in the London Eye.

$$= \frac{\quad:\quad}{\quad} = \boxed{\quad:\quad}$$

i) In 2008, of the 100 seats in the Senate, 84 are held by men. What is the ratio of women to men in the Senate?

$$= \frac{\quad:\quad}{\quad} = \boxed{\quad:\quad}$$

j) Find the ratio of the height of the Statue of Liberty (150 ft) to the height of the Sears Tower, Chicago (1700 ft).

$$= \frac{\quad:\quad}{\quad} = \boxed{\quad:\quad}$$

k) A soccer field is 120 yards long and 80 yards wide. Find the ratio of width to length.

$$= \frac{\quad:\quad}{\quad} = \boxed{\quad:\quad}$$

l) The lowest temperature recorded in the USA is −80°F and in Russia is −90°F. Find the ratio of the lowest temperature in the USA compared to Russia.

$$= \frac{\quad:\quad}{\quad} = \boxed{\quad:\quad}$$

m) The lowest temperature recorded in North America is −81°F and in South America is −27°F. Find the ratio of the lowest temperature in South America compared to North America.

$$= \frac{\quad:\quad}{\quad} = \boxed{\quad:\quad}$$

n) The sensory, language and memory centers are located in the temporal lobe, which is 22% of the total cerebral cortex volume in the brain. Find the ratio of the temporal lobe to the rest of the cortex.

$$= \frac{\quad:\quad}{\quad} = \boxed{\quad:\quad}$$

Skill 14.9   Finding other rates.

$rate = \dfrac{amount}{time}$	$amount = rate \cdot time$	$time = \dfrac{amount}{rate}$
Rate of change	**Amount**	**Time taken**

- Divide the amount by the time taken.
  Example: A 300 L bathtub can be filled in 10 minutes.

  $Rate = \dfrac{30\cancel{0}\,L}{1\cancel{0}\,min} = 30\ L/min$

- Multiply the rate by the time taken.
  Example: Sam worked 7 h at a rate of $16/h.

  $Amount\ (pay) = 16 \cdot 7$
  $= \$112$

- Divide the amount by the rate.
  Example: A Lexmark E232 prints 990 pages at a rate of 22 pages/min (ppm).

  $Time = \dfrac{990\ p}{22\ ppm} = 45\ min$

Q. Some species of bamboo can grow 90 feet per year. At this rate how long will they grow in a month?

A. *rate = 90 ft per year*
1 year = 12 months
rate per month = 90 ft ÷ 12 = 7.5 ft

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a) A Mini Cooper Diesel with a 1.6 L engine emits 104 g/km of the greenhouse gas carbon dioxide (CO_2). How many grams of CO_2 will be emitted during a 400 km trip?

amount (g) = rate (g/km) · distance (km)

= 104 g/km · 400 km   = **41,600 g**

b) Most of the Lambert Glacier (Antarctica) moves around 150 meters in 4 months. At this rate how much will it move in 6 months?

amount =

=   = ☐ m

c) The Kudzu climbing plant can grow up to 364 ft per year. What is this rate in feet per week?

1 year = 52 weeks

rate/wk = 364 ft ÷ 52 wk = ☐

d) It takes 45 minutes to fill a 180-gallon swimming pool. What is the average rate in gallons per minute?

rate =

=   = ☐

e) A Dodge Dakota Pickup 2WD automatic has a city consumption of 15 L of gas per 100 km. How much gas does it need for a 20 km trip?

amount =

=   = ☐ L

f) Every glass bottle recycled saves enough energy to light a 100-watt light bulb for 4 hours. How many bottles are needed to light the same bulb for a week?

1 week =

bottles   = ☐

g) A Honda Civic Hybrid automatic has a highway consumption of 45 L of gas per 100 km. How much gas does it need for a 250 km trip?

amount =

=   = ☐ L

h) The annual fuel cost for a Lamborghini Coupe is around $2490. How much is the cost per month?

1 year =

=   = $ ☐