Index

Key to Unit review question levels:

Level 1–2 | Level 3–4 | Level 5–6 | Level 7–8

NUMBERS

1 **Write down** these numbers in words.

a 32 560 042 **b** 17.08 **c** 1743.14 **d** 2.718

2 Represent these written descriptions as numbers using digits.

a ten thousand four hundred fifty-five

b twenty nine and thirty-two thousandths

c one hundred ninety-thousand six hundred forty-five millionths

d eighteen thousandths

3 Represent these numbers in words and in both expanded forms.

a A blockbuster film made €15 342 807 over a single weekend.

b At its furthest, the moon is 405 696.7 km from the Earth.

c The length of an eyelash mite is 0.1375 mm.

d In 2013, the population of India was 1 252 706 114 people.

e The width of a Siberian Husky's hair is 0.000025 m.

4 Represent these numbers in both expanded forms.

a 12.75 **b** 203.6 **c** 12 004.205 **d** 3.0019

5 **Write down** the given number from its expanded form.

a $500 + 10 + 8 + 0.02 + 0.001$

b $(3 \times 10\,000) + (6 \times 100) + (2 \times 10) + (7 \times 0.01)$

c $9000 + 10 + 0.01 + 0.008$

d $(4 \times 100\,000) + (6 \times 1000) + (2 \times 10) + (3 \times 0.01)$

6 Represent each given number in two other forms.

a 8231.04 **b** $(4 \times 1000) + (3 \times 10) + (5 \times 0.1) + (4 \times 0.001)$

c $8000 + 800 + 0.7 + 0.008 + 0.00002$ **d** 1400.12

7 Evaluate each number.

a 8^3 **b** 12^2 **c** 6^3 **d** 13^2

e 2^4 **f** 3^3 **g** 2^7 **h** 5^4

8 **Use** a grouping strategy to find the value of each summation.

a $24 + 62$ **b** $1 + 8 + 9 + 4 + 2$

c $5 + 3 + 7 + 6 + 5$ **d** $76 + 83$

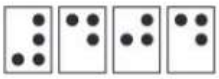
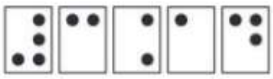
e $340 + 220$ **f** $6 + 8 + 12 + 14 + 20$

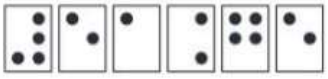
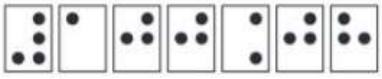
g $400 + 1600$ **h** $98 + 45$

9 Represent these numbers in Braille.

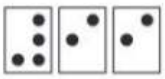
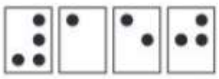
a 28 **b** 362 **c** 12.3 **d** 90.12

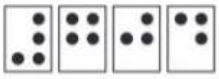
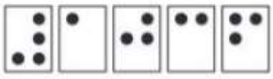
10 Convert these Braille numbers to decimal form.

a  **b** 

c  **d** 

11 Represent these Braille numbers in base-60.

a  **b** 

c  **d** 

12 Multiply these numbers using the visual multiplication method.

a 83×21 **b** 49×16

13 Multiply these numbers using the visual multiplication method.

a 342×17 **b** 121×213

14 Represent these base-10 numbers in base-60.

a 81 **b** 200 **c** 372 **d** 1248

15 Represent these base-60 numbers in base-10.

a 1 14 **b** 3 05 **c** 2 43 **d** 5 00

16 Evaluate these roots.

a $\sqrt{121}$ **b** $\sqrt{64}$ **c** $\sqrt[3]{1000}$ **d** $\sqrt[4]{16}$

e $\sqrt[3]{27}$ **f** $\sqrt{16}$ **g** $\sqrt{4^3}$ **h** $\sqrt{12^2}$

17 Determine if each number is divisible by 3. **Explain** your reasoning.

a 204 **b** 1317 **c** 814 **d** 32422 **e** 501315 **f** 92044

18 Determine if each number is divisible by 8. **Explain** your reasoning.

a 1324 **b** 3080 **c** 71256 **d** 4512 **e** 112316 **f** 5362504

19 List all of the single-digit factors (1 to 9) of each number.

a 64 **b** 256 **c** 1305 **d** 92800 **e** 544 **f** 8280

20 Find the GCF of each set of numbers. Make sure your chosen method is clear.

a 35, 42 **b** 144, 280 **c** 96, 240 **d** 18, 24, 42

e 12, 72, 156 **f** 126, 162, 180 **g** 120, 168, 216 **h** 90, 210, 3000

21 Find the LCM of each set of numbers.

a 36, 54 **b** 45, 60 **c** 12, 30 **d** 9, 15, 30

e 8, 12, 30 **f** 18, 24, 36 **g** 11, 15, 21 **h** 14, 21, 28

22 Celestial objects (like comets, planets and stars) have been observed by civilizations throughout history. Some people viewed these (especially comets and eclipses) as omens of future events while others interpreted them as signs from their gods.

Halley's comet orbits the Earth every 76 years while comet Swift-Tuttle has a 132-year orbit. If they were to pass by Earth in the same year, about how many years later would they again pass by Earth in the same year?

23 Evaluate these expressions, using the correct order of operations.

a $10 + 12 \div 2$

b $12 - 3 \times 3 + 6 \times 2$

c $(3^3 - 12) \div (4^2 - 1)$

d $5(3^2 + 1) + 7 \times 3^2 + 8$

e $168 \div (2^4 + 2^3) + 11 \times \sqrt{169}$

f $2(5^2 + 2 \times 4) - 7 \times 8$

g $\dfrac{4(13-8)+3\times4-4^2}{6^2 \div (2\times9)}$

h $\dfrac{2^3+21\div3-8\div2}{9^2-7\times10}$

i $2\left(8\times3-\sqrt{8^2+6^2}\right)+3^2\times2^3$

j $\dfrac{16[(12-4)-3\times2]+4^2}{8\times4-[2(10-7)+18\div9]}$

24 **Write down** an expression that equals 24 using the four numbers in each set below. You may use parentheses, addition, multiplication, division and/or subtraction, but each number *must* be used and *only once*.

a 2, 4, 5, 11 **b** 2, 3, 10, 12 **c** 3, 4, 9, 6 **d** 1, 3, 4, 8

In questions **24** and **25**, there are many possible answers.

25 Arturo wrote down the equation below to make 24 using the numbers 3, 4, 6, 12.

$$3 + 6 \times 4 - 12 = 24$$

a Is Arturo correct? **Explain**.

b If Arturo is incorrect, make one change to his equation so that his answer is correct.

c Use the numbers 3, 4, 6 and 12 along with one multiplication and two divisions to **write down** another expression that equals 24.

26 Using any numbers of your own choosing, **write down** an expression that uses four different operations (choosing from multiplication, division, subtraction, addition, exponent, and root) where the answer is 20. Remember to obey the correct order of operations.

27 Using any numbers of your own choosing, **write down** an expression that includes at least three exponents, one set of parentheses, one multiplication and one addition, where the answer is 8.

28 In a traditional Mayan medicine garden, herbs were planted for their healing powers, such as Bougainvillea for its antibiotic properties and Calendula for its anti-viral and anti-inflammatory properties.

a If a field was 54 land rods (ancient unit of measurement) by 30 land rods, what are the dimensions of the largest square plots of a single herb that could be planted?

b How many square plots would you have in this field?

c If the field was divided equally between both these types of herbs, how many square plots of Bougainvillea and Calendulas would there be?

ANSWERS

1 **a** Thirty-two million, five-hundred-and-sixty thousand and forty-two
b Seventeen and eight hundredths
c One thousand, seven-hundred-and-forty-three and fourteen hundredths
d Two and seven-hundred-and-eighteen thousandths

2 **a** 10455 **b** 29.032 **c** 0.190645 **d** 0.018

3 **a** $(1 \times 10000000) + (5 \times 1000000) + (3 \times 100000) + (4 \times 10000) + (2 \times 1000) + (8 \times 100) + (7 \times 1)$
$10000000 + 5000000 + 300000 + 40000 + 2000 + 800 + 7$
b $(4 \times 100000) + (5 \times 1000) + (6 \times 100) + (9 \times 10) + (6 \times 1) + (7 \times 0.1)$
$400000 + 5000 + 600 + 90 + 6 + 0.7$
c $(1 \times 0.1) + (3 \times 0.01) + (7 \times 0.001) + (5 \times 0.0001)$
$0.1 + 0.03 + 0.007 + 0.0005$

d $(1 \times 1000000000) + (2 \times 100000000) + (5 \times 10000000) + (2 \times 1000000) + (7 \times 100000) + (6 \times 1000) + (1 \times 100) + (1 \times 10) + (4 \times 1)$
$1000000000 + 200000000 + 50000000 + 2000000 + 700000 + 6000 + 100 + 10 + 4$
e $(2 \times 0.00001) + (5 \times 0.000001)$
$0.00002 + 0.000005$

4 **a** $(1 \times 10) + (2 \times 1) + (7 \times 0.1) + (5 \times 0.01)$
$10 + 2 + 0.7 + 0.05$
b $(2 \times 100) + (3 \times 1) + (6 \times 0.1)$
$200 + 3 + 0.6$
c $(1 \times 10000) + (2 \times 1000) + (4 \times 1) + (2 \times 0.1) + (5 \times 0.001)$
$10000 + 2000 + 4 + 0.2 + 0.005$
d $(3 \times 1) + (1 \times 0.001) + (9 \times 0.0001)$
$3 + 0.001 + 0.0009$

5 **a** 518.021 **b** 30620.07 **c** 9010.0108 **d** 406020.03

6 **a** $(8 \times 1000) + (2 \times 100) + (3 \times 10) + (1 \times 1) + (4 \times 0.01)$
$8000 + 200 + 30 + 1 + 0.04$
b $4000 + 30 + 0.5 + 0.004$
4030.504
c $(8 \times 1000) + (8 \times 100) + (7 \times 0.1) + (8 \times 0.001) + (2 \times 0.00001)$
8800.70802
d $(1 \times 1000) + (4 \times 100) + (1 \times 0.1) + (2 \times 0.01)$

7 **a** 512 **b** 144 **c** 216 **d** 169
e 16 **f** 27 **g** 128 **h** 625

8 **a** 86 **b** 24 **c** 26 **d** 159
e 560 **f** 60 **g** 2000 **h** 143

9 **a**  **b**  **c**  **d** 

10 **a** 404 **b** 3.14 **c** 51.75 **d** 144.48

11 **a** 1 39 **b** 2 30 **c** 11 44 **d** 17 16

12 **a** 1743 **b** 784

13 **a** 5814 **b** 25773

14 **a** 1 21 **b** 3 20 **c** 6 12 **d** 20 48

15 **a** 74 **b** 185 **c** 163 **d** 300

16 **a** 11 **b** 8 **c** 10 **d** 2
e 3 **f** 4 **g** 8 **h** 12

17 **a** Yes **b** Yes **c** No **d** No
e Yes **f** No

18 **a** No **b** Yes **c** Yes **d** Yes
e No **f** Yes

19 **a** 1, 2, 4, 8 **b** 1, 2, 4, 8 **c** 1, 3, 5, 9 **d** 1, 2, 4, 5, 8
e 1, 2, 4, 8 **f** 1, 2, 3, 4, 5, 6, 8, 9

20 **a** 7 **b** 8 **c** 48 **d** 6
e 12 **f** 18 **g** 24 **h** 30

21 **a** 108 **b** 180 **c** 60 **d** 90
e 120 **f** 72 **g** 1155 **h** 84

22 2508 years

23 **a** 16 **b** 15 **c** 1 **d** 121
e 150 **f** 10 **g** 8 **h** 1
i 100 **j** 2

24 For example:
a $2\times(11+5-4)=24$
b $12\times(10+(3+2))=24$
c $(3+9)\times(6-4)=24$
d $(1+3)\times4+8=24$

25 **a** No. Arturo simply worked from left to right rather than using the correct order of operations.
b Individual response e.g. $12+6\times4-12=24$
c For example: $(4\times3)+(6+12)=24$ or $(12\times3)+(6+4)=24$

26 Individual response

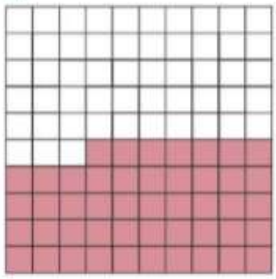
27 Individual response

28 **a** 6 **b** 45 **c** 22.5

PERCENTAGES

1 **Write down** the percentage represented by the shaded section of each grid.

a



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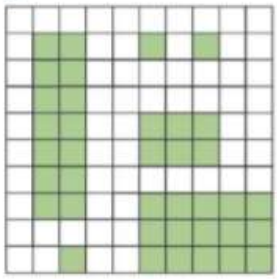
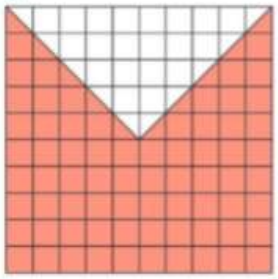
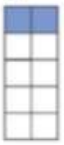


c

d



e



2 For each percentage below, **draw** two grids of different sizes and then shade the given percentage.

a 30% **b** 50% **c** 75% **d** 18% **e** 12%

3 If you knew what 3%, 8% and 10% of a quantity was, how could you **calculate** the following percentages of the same quantity?

a 9% **b** 11% **c** 21% **d** 18% **e** 16% **f** 26% **g** 77%

4 If 20% of a quantity is 30, find the following percentages of the same quantity.

a 10% **b** 40% **c** 100% **d** 30% **e** 4% **f** 24%

5 Convert these fractions to percentages.

a $\frac{9}{10}$ **b** $\frac{17}{20}$ **c** $\frac{14}{7}$ **d** $\frac{3}{12}$ **e** $\frac{22}{55}$

f $\frac{20}{50}$ **g** $\frac{12}{60}$ **h** $\frac{8}{99}$ **i** $\frac{37}{37}$ **j** $\frac{40}{11}$

6 Convert these fractions to percentages, and round to the nearest whole percentage.

a $\frac{3}{13}$ **b** $\frac{8}{5}$ **c** $\frac{14}{47}$ **d** $\frac{61}{66}$ **e** $\frac{7}{19}$

f $\frac{31}{51}$ **g** $\frac{12}{3}$ **h** $\frac{153}{88}$ **i** $\frac{36}{35}$ **j** $\frac{212}{100}$

7 **Write down** the following in all three forms: fraction, decimal and percentage. Give each fraction in its simplest form.

a 28% **b** 0.8 **c** $\frac{13}{20}$ **d** 0.32 **e** 55%

f $\frac{7}{15}$ **g** 92% **h** $\frac{4}{20}$ **i** $0.\overline{60}$ **j** 110%

8 Which is the largest number in each of the following lists? **Justify** your answer.

a $\frac{4}{5}$ or 75% or 0.81 **b** 0.92 or 90% or $\frac{17}{19}$ **c** $\frac{2}{3}$ or 65% or 0.63

d $\frac{1}{4}$ or 26% or $0.\overline{25}$ **e** 0.55 or 53% or $\frac{6}{13}$

9 Which numbers are equivalent in each of the following sets?

a $\frac{12}{50}$, 25%, $\frac{1}{4}$, 0.24, $\frac{3}{8}$, 2.4%, 24%

b 5%, $\frac{2}{20}$, 0.5, $\frac{30}{600}$, 50%, $\frac{1}{2}$, 0.05

10 In the 2016 Olympics, the International Olympic Committee created a 'Refugee Olympic Team' to draw attention to the worldwide refugee crisis. Ten athletes were selected from four countries to take part in this team. **Calculate** the percentage of athletes from the following countries of origin.

a 5 athletes were originally from South Sudan.

b 2 athletes were originally from Syria.

c 1 athlete was originally from Ethiopia.

11 There are an estimated 700 million children living in the world who are of primary school age. Approximately 70 million of them still do not have access to education. Approximately what percentage of primary-age children do not have access to education?

12 In the United States Senate, 20 senators out of 100 are women. In Canada, 88 women have been elected to the House of Commons out of 338 members. Which country has the higher percentage of women in its government house?

13 **a** What percentage of 50 is 10?

b What is 30% of 20?

c 15 is 45% of what number?

d What is 60% of 90?

e 40 is 25% of what number?

f What percentage of 80 is 60?

14 Due to the efforts of many charitable organizations, enrollment in primary education has reached approximately 90% worldwide. If there are approximately 60 million children still not attending schools, approximately how many are enrolled in primary schools?

15 Many charitable organizations have worked hard to reduce child mortality. Since 1990, the number of deaths worldwide in children under five years old declined from approximately 13 million to approximately 6 million.

a What is the approximate percentage decrease?

b Assuming a constant rate of change, by approximately what percentage did the number of deaths drop per year?

c If this trend continues at the same rate, what would you predict to be the number of deaths in children under five years old in ten years' time?

16 Approximately 780 million people in the world are illiterate. What percentage is that of the total population? (You found this statistic earlier in this unit). Of the 780 million, almost 70% are female. Approximately how many females are illiterate in the world?

17 **a** Before 2011, a typical Syrian could expect to live to be about 80 years old.
In 2014, during a civil war where millions of people died, life expectancy in Syria decreased to 56 years old. **Calculate** the percentage decrease in life expectancy.

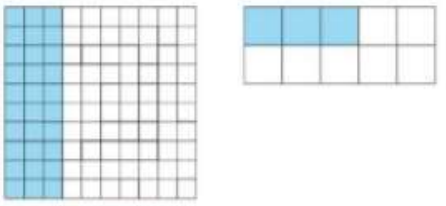
b Due to the civil war, 4 million refugees fled Syria. Some of these refugees fled to neighboring Jordan, where the population swelled from approximately 5 850 000 to approximately 6 500 000. **Calculate** the percentage increase in the population of Jordan.

c Lebanon, another country that took in many refugees, saw its population increase from roughly 3 million to 4 million. **Calculate** the percentage increase in the population of Lebanon.

ANSWERS

1 **a** 47% **b** 38% **c** 65%
d 75% **e** 20%

2 **a**



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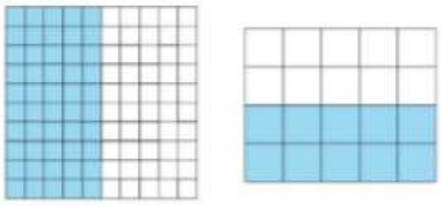

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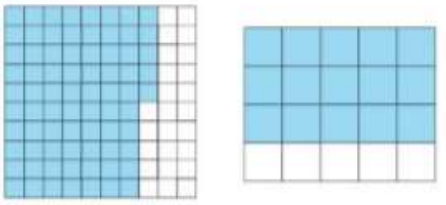

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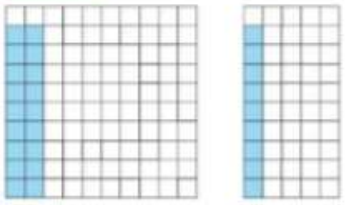
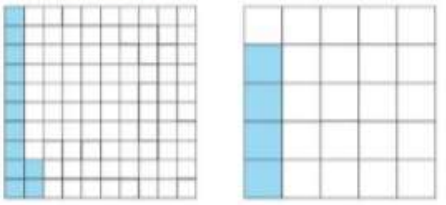


e



3 Valid answers include:
a 9% : three lots of 3%
b 11% : one lot of 3% plus one lot of 8%
c 21%: one lot of 3% plus one lot of 8% plus on lot of 10%
d 18%: one lot of 8% plus one lot of 10%
e 16%: two lots of 8%
f 26%: two lots of 8% plus one lot of 10%
g 77%: nine lots of 3% plus five lots of 10%

4 **a** 16 **b** 60 **c** 150
d 45 **e** 6 **f** 36

5 **a** 90% **b** 85% **c** 200% **d** 25%
e 40% **f** 40% **g** 20% **h** 8.08%
i 100% **j** 363.64%

6 **a** 23% **b** 23% **c** 30% **d** 92%
e 37% **f** 61% **g** 16% **h** 174%
i 103% **j** 212%

7 **a** $\frac{7}{25} = 0.28 = 28\%$ **b** $\frac{4}{5} = 0.8 = 80\%$ **c** $\frac{13}{20} = 0.65 = 65\%$ **d** $\frac{8}{25} = 0.32 = 32\%$
e $\frac{11}{20} = 0.55 = 55\%$ **f** $\frac{7}{15} = 0.47 = 46.67\%$ **g** $\frac{23}{25} = 0.92 = 92\%$ **h** $\frac{1}{5} = 0.2 = 20\%$
i $\frac{3}{5} = 0.6 = 60\%$ **j** $\frac{11}{10} = 1.1 = 110\%$

8 **a** 0.81 **b** 0.92 **c** $\frac{2}{3}$
d 26% **e** 0.55

9 **a** $25\% = \frac{1}{4}$ and $\frac{12}{50} = 0.24 = 24\%$ **b** $5\% = \frac{30}{600} = 0.05$ and $0.5 = 50\% = \frac{1}{2}$

10 **a** 50% **b** 20% **c** 10%

11 10%

12 Canada

13 **a** 20% **b** 6 **c** $33.3\overline{3}$
d 54 **e** 160 **f** 75%

14 540 million

15 **a** 53.85% decrease **b** See comment **c** 3.5 million

16 10.4% assuming world population of 7.5 billion
546 million

17 **a** 30% decrease **b** 11.11% **c** 33.33%

ALGEBRA

1 What are the next two terms in each of the following sequences? **Explain** your reasoning.

a	5	10	20	40	80	___	___
b	1	6	11	16	21	___	___
c	31	28	31	30	31	___	___
d	96	48	24	12	6	___	___
e	10	20	30	40	50	___	___

Not all sequences follow a mathematical pattern. In part **c**, look carefully at the numbers and think about what might come in groups of 31, 30, etc.

2 **Identify** the core of the each pattern.

a

b

c

3 Translate each of the following phrases into a mathematical expression. **Use** whatever letter or symbol you like for the original number.

a 28 divided by a number
b A number decreased by 4
c 4 more than a number
d 17 times a number
e A number added to 12
f A number multiplied by 13
g 6 less than a number
h 3 more than twice a number

4 Translate these mathematical expressions back into words.

a $4x$ **b** $\frac{63}{a}$ **c** $y - 15$ **d** $61 + z$ **e** $3x + 7$

5 Substitute the given number into each expression to **find** the value of the expression.

a $x - 12$, when $x = 20$ **b** $15 - 3x$, when $x = 2$ **c** $\frac{x+4}{6}$, when $x = 20$

6 **Solve** each equation.

a $x + 25 = 40$ **b** $7x = 56$ **c** $m - 10 = 11$ **d** $\frac{p}{8} = 3$

e $9b = 63$ **f** $w - 14 = 6$ **g** $h + 52 = 61$ **h** $z - 19 = 21$

i $\frac{d}{10} = 15$ **j** $12x = 96$ **k** $m + 25 = 44$ **l** $\frac{n}{7} = 7$

m $g - 15 = 23$ **n** $5y = 55$ **o** $a - 71 = 43$ **p** $36 - x = 12$

7 **a** **Draw** the next two shapes in the sequence below. **Explain** the pattern in words.

b Determine what the 10th term in the sequence would be, without drawing it. How do you know?

c Will the number 78 be in this sequence? **Explain** why or why not.

d **Write down** a rule to find the next term of the sequence if you know the one before it.

8 **a** **Draw** the next two shapes in the pattern and **explain** the pattern in words.

b Determine what the 20th term in the sequence would be, without drawing it. How do you know?

c Will the number 46 be in this sequence? **Explain** why or why not.

d **Write down** a rule to find the next term of the sequence if you know the one before it.

9 **a** **Draw** the next two shapes in the pattern below and **explain** the pattern in words.

b Will the number 100 be in this sequence? **Explain** why or why not.

10 On squared paper, **draw** a pattern for the first *five* terms in the sequence that begins 2, 6, 10, ...

11 **Solve** these equations.

a $2x + 10 = 16$

b $\frac{a}{4} = 7$

c $20 - 2g = 4$

d $\frac{4h}{11} + 23 = 15$

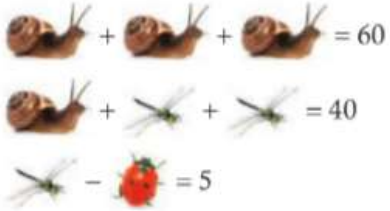
12 Monarch butterflies are native to North America. They cannot survive the cold winter months of northern US and Canada so they migrate to southern California and Mexico. They use the Earth's magnetic field to help them travel an astonishing 3000 miles in some cases. On the first day they travel 75 miles. By the end of the second day they have travelled 150 miles. After one week, they have covered 525 miles.

a **Write down** an equation relating the number of days d and the number of miles travelled m.

b How long does it take a Monarch butterfly to travel its entire journey of 3000 miles?

c If a Monarch butterfly has a lifespan of 6 to 8 months, what fraction of its life is spent in migration?

13 **Use** the three equations below to determine the value of the snail, the dragonfly and the ladybug.



Then **use** the equation below to check your answer.

14 Hawksbill turtles travel great distances to return to nesting sites to lay their eggs. A single female hawksbill can lay up to 200 eggs in one nest, called a *clutch*. In the first 3 seconds, 7 eggs are laid. After that, one new egg is laid in the clutch every second.

a Starting at 3 seconds, create a table for the number of eggs in the clutch during the first 10 seconds.

b **Write down** an equation to represent the relationship between the number of eggs e and time t, when $t \geq 3$.

c **Use** your equation to find how long it will take for 200 eggs to be laid.

d **Use** your equation to find how long it will take for 153 eggs to be laid.

15 Hawksbills, like most turtles, lay their eggs in a chamber which they dig out with their flippers. Newly hatched hawksbills are not strong enough to dig themselves out of the chamber so, as eggs hatch, they stimulate other eggs to hatch. The group of hatchlings can then dig themselves out together. The number of hatched eggs as a function of time is represented below.

Time (seconds)	Number of hatched eggs
1	2
3	6
10	20
15	30

a **Write down** an equation to represent the relationship between the number of hatched eggs e and the elapsed time t.

b **Use** your equation to **find** how long it will take for all 200 eggs to hatch. Write your answer in minutes.

c How long will it take for 80 eggs to hatch?

ANSWERS

1 **a** 160 320 (the next term is double the current term)
b 26 31 (the next term is the current term plus 6)
c 32 31 (alternating sequence with 31 and terms increasing by 2)
d 3 1.5 (the next term is half the current term)
e 60 70 (the next term is the current term plus 10)

2 ?

3 **a** $\frac{28}{n}$ provided n is non-zero **b** $n-4$ **c** $n+4$ **d** $17n$
e $12+n$ **f** $13n$ **g** $n-6$ **h** $2n+3$

4 **a** Four times a number
b 63 divided by a number (that is non-zero)
c 15 less than a number
d 61 more than a number
e 7 added to 3 times a number

5 **a** 8 **b** 9 **c** 4

6 **a** $x=15$ **b** $x=8$ **c** $m=21$ **d** $p=24$
e $b=7$ **f** $w=20$ **g** $h=9$ **h** $z=40$
i $d=150$ **j** $x=8$ **k** $m=19$ **l** $n=49$
m $g=38$ **n** $y=11$ **o** $a=114$ **p** $x=24$

7 **a** From one shape to the next, add a ladybird to each endpoint
b The 10th term would have 1 ladybird in the centre, with two arms of 10 ladybirds each, for a total of 21 ladybirds.
c No, 78 will not be in the sequence because it is an even number, and this is the sequence of odd numbers starting with 3.
d If the current term is n then the next term is $n+2$

8 **a** The first shape in the sequence contains two clouds. Each subsequent shape contains three more clouds than the previous one, so the sequence is 2, 5, 8, 11, 14, ...
b The first shape contains 2 clouds. Each subsequent shape adds 3 more clouds, so the 20th term will contain $2 + 19(3) = 59$ clouds.
c No, the pattern rule is $3n - 1$, where n is the term number, so no integer value of n will give 46.
d If the current term is n then the next term is $n+3$

9 **a** The n^{th} term is n by n lightning bolts
b Yes, the pattern rule is $t = n^2$, where n is the term number. These are simply the square numbers: 1, 4, 9, 16, etc. so as 100 is the square of 10 it will be in the sequence.

10 Individual response

11 **a** $x=3$ **b** 28 **c** $g=8$ **d** $h=-22$

12 **a** $m=75d$ **b** 40 days **c** Between $\frac{2}{9}$ and $\frac{1}{6}$

13 Snail = 20
Dragonfly = 10
Ladybug = 5

14 a

Seconds	Eggs in the clutch
3	7
4	8
5	9
6	10
7	11
8	12
9	13
10	14

b $e = 7 + (t - 3) = t + 4$

c 196 seconds

d 149 seconds

15 a $e = 2t$ **b** $\frac{5}{3}$ of a minute **c** 40 seconds

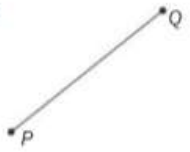
GEOMETERY

1 **Draw** an example for each of the following.

a $\overleftrightarrow{EF}$ **b** $\overline{XY}$ **c** $\overrightarrow{RS}$ **d** point T **e** $\overline{AD} \perp \overline{JM}$ **f** $\overleftrightarrow{TV} \parallel \overleftrightarrow{YZ}$

2 **Write down** expressions for each diagram, using mathematical notation.

a



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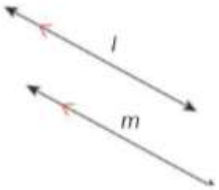
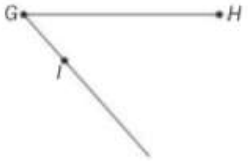


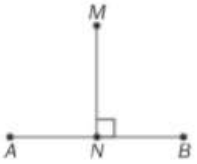
c

d

e

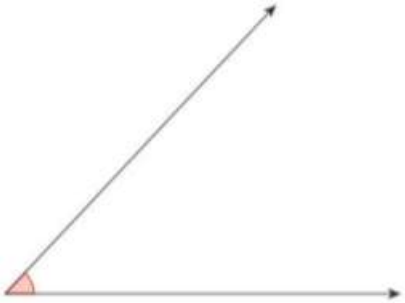


f



3 Using a protractor, **measure** and classify each angle.

a



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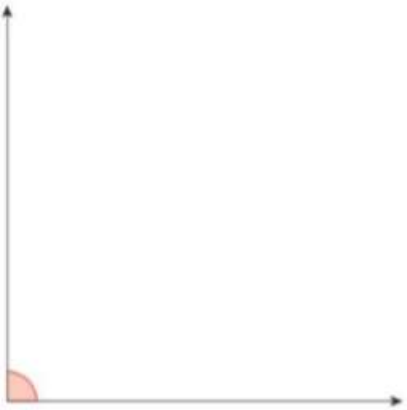

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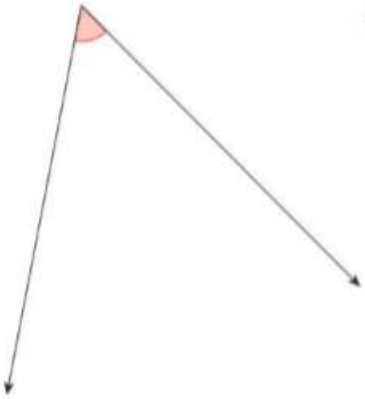
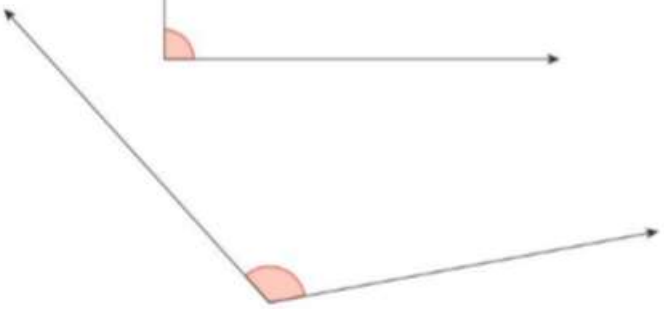


d



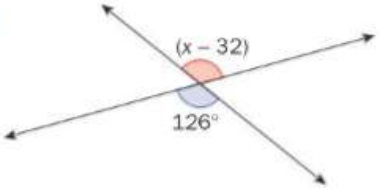
4 Using a protractor, **draw** the following angles.

a 152° **b** 68° **c** 34° **d** 119° **e** 90° **f** 14°

5 Find the complement and supplement of each angle in question **4**, if it exists.

6 For each diagram, **write down** an equation and **solve** it to determine the value of x.

a



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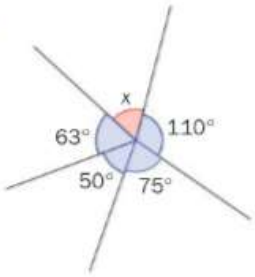
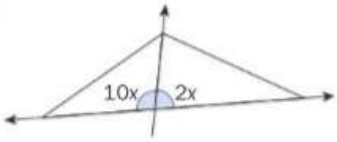
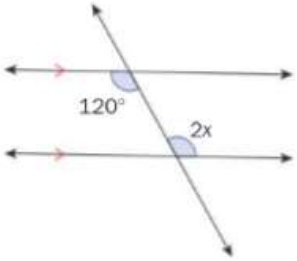


c



d



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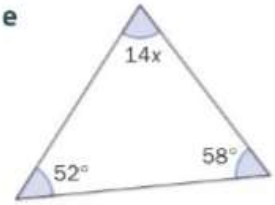
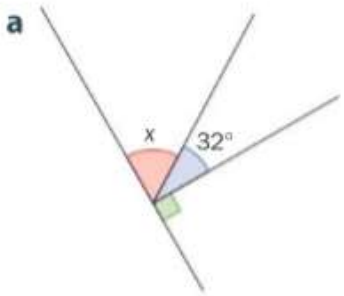


7 **Show** that the two acute angles in a right-angled triangle must be complementary.

8 Find the measures of the indicated angles. **Justify** your answers.

a



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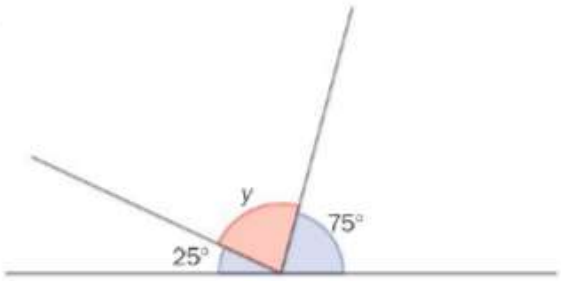

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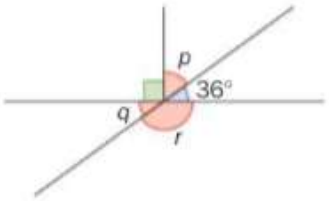
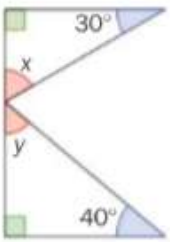
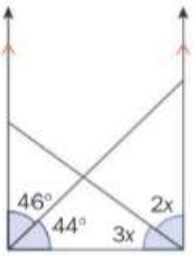


d

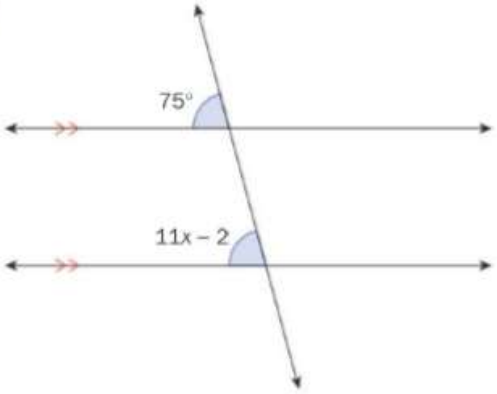


9 For each diagram, **write down** an equation and **solve** it to determine the value of x.

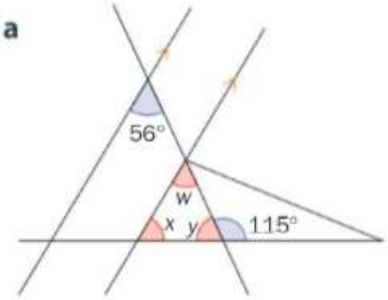
a



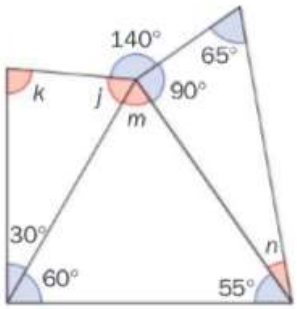
b



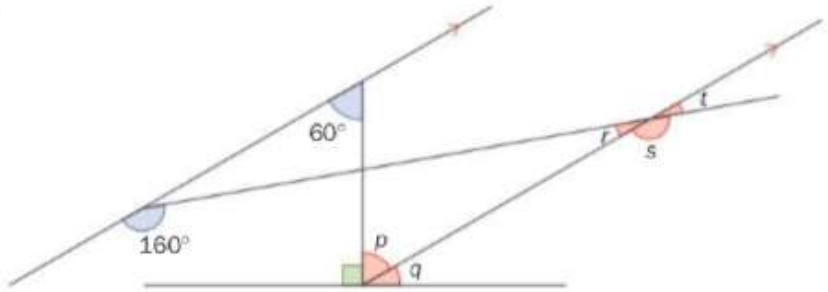
10 a



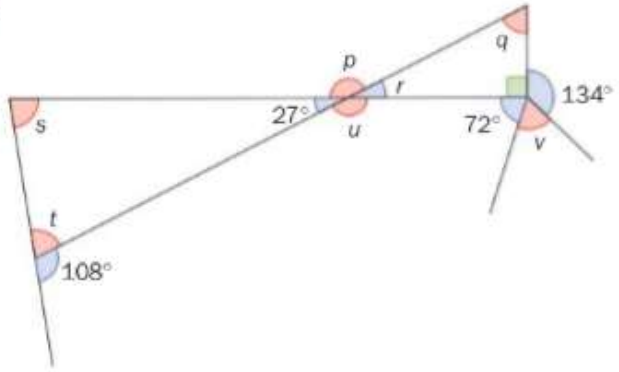
b



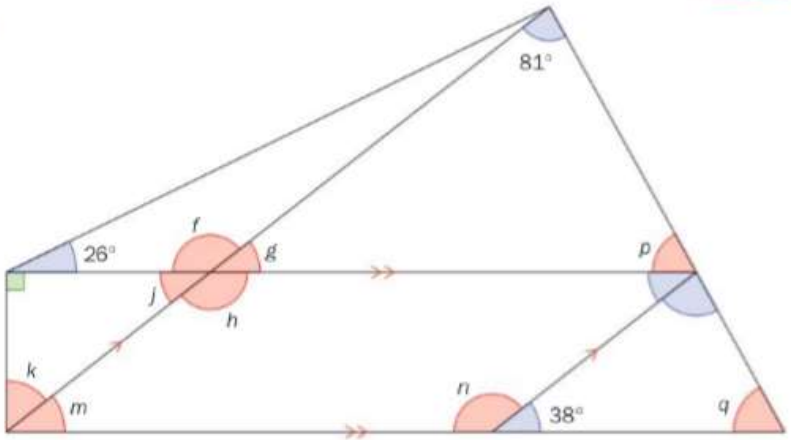
c



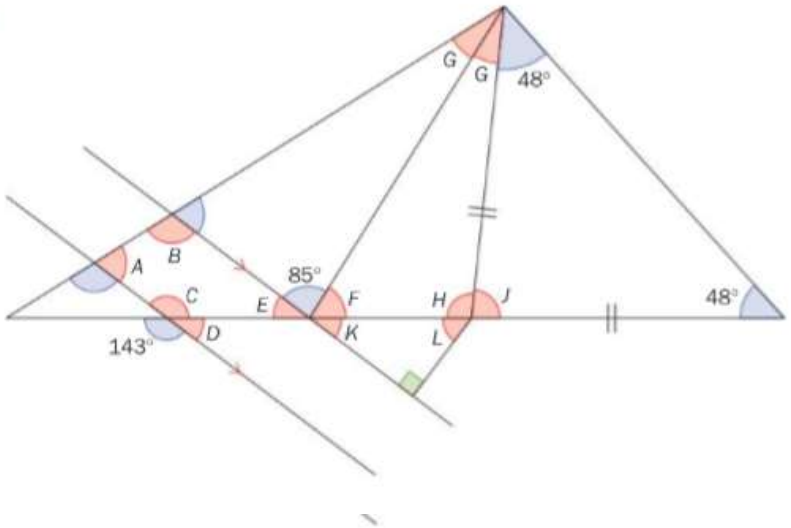
d



e



f

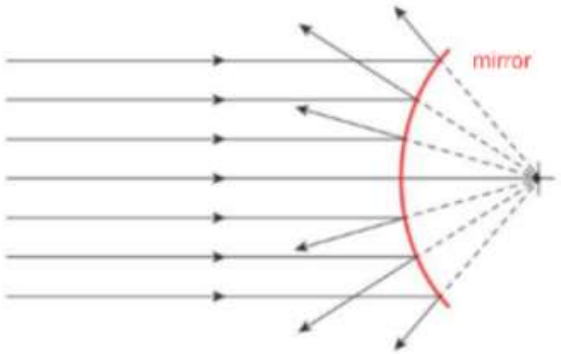


In part **f**, notice that the two angles marked *G* are equal, as are the two side lengths marked with ticks.

11 In Science class, during a study of mirrors, Svetlana noticed that the diagrams showing how light reflects off of a curved mirror used many of the same elements that she found in her Mathematics class.

a Looking at the diagram here, **identify** as many elements from this unit as you can. These can include basic elements like rays and lines as well as all the types of angle that you have seen so far.

b How does mathematics help you understand what is represented in the image?



ANSWERS

1 **a** Line through E and F
b Line segment between X and Y
c Line from R through S
d A point labelled T
e Perpendicular lines; a line through A and B perpendicular to a line through J and M
f Parallel lines; a line through T and V parallel to a line through Y and Z

2 **a** $\overrightarrow{PQ}$ **b** $l \parallel m$ **c** $\overline{GH}$
d $\overrightarrow{PQ}$ **e** $\angle HGI$ or $\angle IGH$ **f** $\overline{AB} \perp \overline{MN}$

3 **a** 47 degrees, acute
b 90 degrees, right-angle
c 56 degrees, acute
d 120 degrees, obtuse

4 Individual response

5 **b** 22 degrees **c** 56 degrees **f** 76 degrees

6 **a** $x = 158$ **b** $x = 62$ **c** $x = 15$
d $x = 60$ **e** $x = 5$

7 Sum of interior angles in a triangle is 180 degrees. There exists a right-angle, so the remaining two angles must sum to $180 - 90 = 90$

8 **a** $x = 58$ **b** $y = 80$ **c** $p = 54, q = 36, r = 108$ **d** $x = 60, y = 50$

9 **a** $x = 18$ **b** $x = 7$

10 **a** $w = 56, x = 59, y = 65$
b $j = 65, k = 85, m = 65, n = 25$
c $p = 60, q = 30, r = 20, s = 160, t = 20$
d $p = 153, q = 63, r = 27, s = 81, t = 72, u = 153$
e $f = 142, g = 38, h = 142, j = 38, k = 52, m = 38, n = 142, p = 61, q = 61,$
f $A = 59, B = 111, C = 153, D = 37, E = 37, F = 58, G = 26, H = 96, J = 84, K = 37, L = 53$

11 Individual response

FRACTIONS

1 Compare each pair of fractions using > or <.
Explain your reasoning.

a $\frac{3}{7}, \frac{2}{5}$ **b** $\frac{7}{10}, \frac{5}{8}$ **c** $\frac{4}{11}, \frac{2}{7}$

d $\frac{13}{20}, \frac{5}{9}$ **e** $\frac{5}{12}, \frac{9}{16}$ **f** $\frac{17}{21}, \frac{5}{6}$

2 Arrange each set of fractions from least to greatest.
Show all of your working.

a $\frac{1}{3}, \frac{5}{12}, \frac{5}{6}, \frac{17}{24}, \frac{7}{8}, \frac{1}{2}$ **b** $\frac{3}{5}, \frac{7}{10}, \frac{27}{50}, \frac{11}{25}, \frac{1}{2}, \frac{3}{4}$

3 In a recent survey of adolescents, participants read the following statement: 'It bothers me when my friends and family use technology when spending time with me.'

- $\frac{11}{50}$ of all respondents *strongly* agreed
- $\frac{1}{2}$ agreed
- $\frac{1}{5}$ neither agreed nor disagreed
- $\frac{2}{25}$ disagreed.

a Rank the responses in increasing order of the number of people who chose each one. **Show** all of your working.

b What fraction of respondents agreed or strongly agreed?

c Does your answer to **b** surprise you? **Explain**.

4 Perform the following operations.

a $\frac{2}{5}+\frac{4}{5}$ **b** $\frac{12}{17}-\frac{9}{17}$ **c** $\frac{3}{5}\times\frac{1}{7}$ **d** $\frac{6}{11}+\frac{4}{11}$

5 Perform the following operations.

a $\frac{12}{27}\times\frac{18}{15}$ **b** $\frac{6}{21}\div\frac{72}{7}$ **c** $\frac{6}{7}+\frac{2}{21}$ **d** $\frac{3}{5}-\frac{1}{3}$

e $\frac{4}{9}+\frac{5}{12}$ **f** $\frac{9}{10}-\frac{3}{8}$ **g** $7\frac{2}{3}\times 2\frac{1}{10}$ **h** $6\frac{10}{11}\div 2\frac{3}{8}$

6 Using only a $\frac{1}{4}$ measuring cup and a $\frac{1}{3}$ measuring cup, how would you make the following amounts for a recipe? **Show** your working.

a $\frac{1}{2}$ cup **b** 1 cup **c** $\frac{7}{12}$ cup **d** $1\frac{5}{12}$ cup

7 The festival of Holi, celebrated mainly in India and Nepal, is also called the Festival of Colors because participants chase and color each other with bright, vivid wet and dry colors. It is considered to bridge the social gap as everyone who participates can be chased and colored, regardless of age, race, gender or social status. It is said that even enemies become friends during Holi. It is a time to give blessings and spend time with the community.

Different natural ingredients are mixed with flour to make dry colors. The same ingredients can be mixed with water to make wet colors or pastes.

a To make a dry yellow color, you can mix 4 teaspoons of turmeric powder with 7 teaspoons of flour.
To make a blue color, you can mix 3 teaspoons of dried jacaranda flowers with 5 teaspoons of flour.
Which mixture has a higher concentration (fraction) of color?
Show your working.

b To make a wet red color, you can mix 2 teaspoons of red sandalwood powder with 2 liters of water and bring to a boil. Then you add 5 more liters of water to dilute the color.

To make a wet orange color, you can mix 4 teaspoons of saffron with 3 liters of water, bring it to a boil, and then add 10 more liters.
Which mixture has a higher concentration of color?
Show your working.

c If $\frac{4}{5}$ of the people of India and $\frac{7}{9}$ of the people of Nepal celebrate Holi, which country has a larger relative participation in the event, and by how much? **Show** your working.

8 Here are two questions with answers from students.

Evaluate: $\frac{5}{14} \div 3\frac{4}{7}$

Eric's answer:

$$\begin{aligned}\frac{5}{14} \div 3\frac{4}{7} &= \frac{5}{14} \div \frac{19}{7} \\ &= \frac{5}{14} \times \frac{7}{19} \\ &= \frac{5}{2} \times \frac{7}{19} \\ &= \frac{35}{38}\end{aligned}$$

Evaluate: $\frac{5}{9} + \frac{6}{15}$

Amanda's answer:

$$\begin{aligned}\frac{5}{9} + \frac{6}{15} &= \frac{{}^{1}\cancel{5}}{{}_{3}\cancel{9}} + \frac{{}^{2}\cancel{6}}{{}_{3}\cancel{15}} \\ &= \frac{1}{3} + \frac{2}{3} \\ &= \frac{3}{6} \\ &= \frac{1}{2}\end{aligned}$$

For each student's response:

a **explain** any errors in the workings

b **explain** what needs to be done to fix the solution

c **solve** the question properly, listing the correct problem-solving process steps.

9 Perform the following operations.

a $\frac{1}{6} + \frac{1}{3} - \frac{2}{9}$ **b** $\frac{1}{6} \times \frac{3}{5} \div \frac{3}{10}$ **c** $\left(\frac{3}{4} + \frac{5}{8}\right) \div \frac{24}{33}$ **d** $\left(\frac{1}{5}\right)^2 \div \frac{3}{10}$

10 Barbecue (or BBQ) is a style of cooking that is very popular in the southern United States. In the 19th century, barbecue was a featured dish at all kinds of activities, from social gatherings to political rallies to family reunions. To this day, barbecue is a centerpiece of activities that promote human connections and relationships in the southern USA. There are many kinds of barbecue sauce; a recipe for South Carolina style sauce is given below.

The recipe makes $2\frac{1}{2}$ cups and you need to make 4 cups.

a By how much do you need to multiply each of the ingredients to make 4 cups' worth?

b Rewrite the recipe to make 4 cups.

c Are there any ingredients that would be difficult to measure for the new recipe? How would you be able to use the correct amount?

11 Thanksgiving is a holiday celebrated primarily in North America. It was originally a day to give thanks for the harvest and the year.
It is a time when more Americans travel to be with family than any other holiday, including Christmas.

Eating turkey is a tradition on Thanksgiving. In the United States, 50 million turkeys are eaten on the holiday. The total number of turkeys eaten each year in the US is 250 million. The population of the United States is approximately 320 million people, which means roughly $\frac{3}{4}$ of a turkey per person each year!

a What fraction of the year's turkey consumption is on Thanksgiving?

b Approximately 50 million Americans travel over the Thanksgiving holiday. What fraction of the US population does this represent?

c Of those travelling, $\frac{9}{10}$ will be driving to their destination and $\frac{2}{25}$ will be flying. What fraction of those travelling will not be driving or flying? What modes of transportation do you think they will take?

d What fraction of the total US population will be flying to their destination for Thanksgiving?

ANSWERS

1 **a** $\frac{3}{7} > \frac{2}{5}$ **b** $\frac{7}{10} > \frac{5}{8}$ **c** $\frac{4}{11} > \frac{2}{7}$

d $\frac{13}{20} > \frac{5}{9}$ **e** $\frac{5}{12} < \frac{9}{16}$ **f** $\frac{17}{21} < \frac{5}{6}$

2 **a** $\frac{1}{3}, \frac{5}{12}, \frac{1}{2}, \frac{17}{24}, \frac{5}{6}, \frac{7}{8}$ **b** $\frac{11}{25}, \frac{1}{2}, \frac{27}{50}, \frac{3}{5}, \frac{7}{10}, \frac{3}{4}$

3 **a** Disagreed, Neutral, Strongly Agreed, Agreed **b** $\frac{18}{25}$ **c** Individual response

4 **a** $\frac{6}{5}$ **b** $\frac{3}{17}$ **c** $\frac{3}{35}$ **d** $\frac{10}{11}$

5 **a** $\frac{8}{15}$ **b** $\frac{1}{36}$ **c** $\frac{20}{21}$ **d** $\frac{4}{15}$

e $\frac{31}{36}$ **f** $\frac{21}{40}$ **g** $\frac{161}{10}$ **h** $\frac{32}{11}$

6 **a** $2 \times \frac{1}{4}$ cup **b** $4 \times \frac{1}{4}$ cup or $3 \times \frac{1}{3}$ cup **c** $1 \times \frac{1}{4}$ cup $+ 1 \times \frac{1}{3}$ cup **d** $3 \times \frac{1}{4}$ cup $+ 2 \times \frac{1}{3}$ cup

7 **a** $\frac{4}{11} < \frac{3}{8}$ so blue **b** $\frac{2}{7} < \frac{4}{13}$ so orange **c** India

8 Eric **a** First line: incorrect conversion from improper to mixed fraction
Second to third line: incorrect diagonal cancellation

b, c $\frac{5}{14} + 3\frac{4}{7} = \frac{5}{14} + \frac{25}{7} = \frac{5}{14} \times \frac{7}{25} = \frac{1}{10}$

Amanda **a** First line: you cannot perform diagonal cancellation when adding fractions
Second to third line: incorrect addition of fractions

b, c $\frac{5}{9} + \frac{6}{15} = \frac{25}{45} + \frac{18}{45} = \frac{43}{45}$

9 **a** $\frac{5}{18}$ **b** $\frac{1}{3}$ **c** $\frac{121}{64}$ **d** $\frac{2}{15}$

10 **a** $\frac{8}{5}$

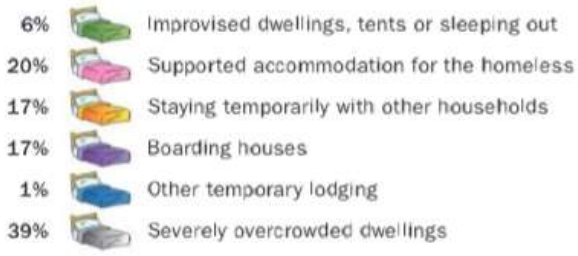
b 2 sticks of butter
$\frac{4}{5}$ small, sweet onion, grated
1 cup yellow mustard
$\frac{6}{5}$ cup dark brown sugar
$\frac{3}{5}$ cup apple cider vinegar
2 tablespoons dry mustard
$\frac{4}{5}$ teaspoon cayenne pepper
$\frac{16}{5}$ bay leaves
Salt & pepper to taste

c Individual response

11 **a** $\frac{1}{5}$ **b** $\frac{5}{32}$ **c** $\frac{1}{50}$ Individual response **d** $\frac{2}{125}$

DATA MANAGEMENT

1 This infographic, compiled by Homelessness Australia, shows the dwelling situation for homeless people in Australia.



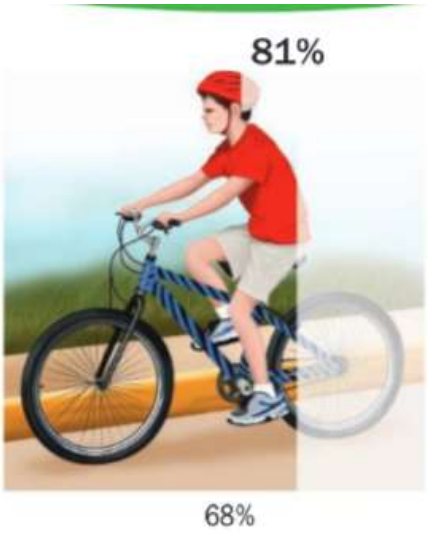
a What kind of data (categorical, ordinal, discrete or continuous) is being collected? **Explain** your reasoning.

b **Describe** what this graph is displaying.

c What aspects of this graph make it effective? What aspects make it less effective? Give reasons for your answers.

d What type of graph do you think would be more effective at representing this data? **Explain** your choice. **Draw** the graph.

2 In a survey carried out in the US on youth risk behavior, it was found that of the 68% of high school students who rode bikes in the last year, 81% of them rarely or never wore helmets.

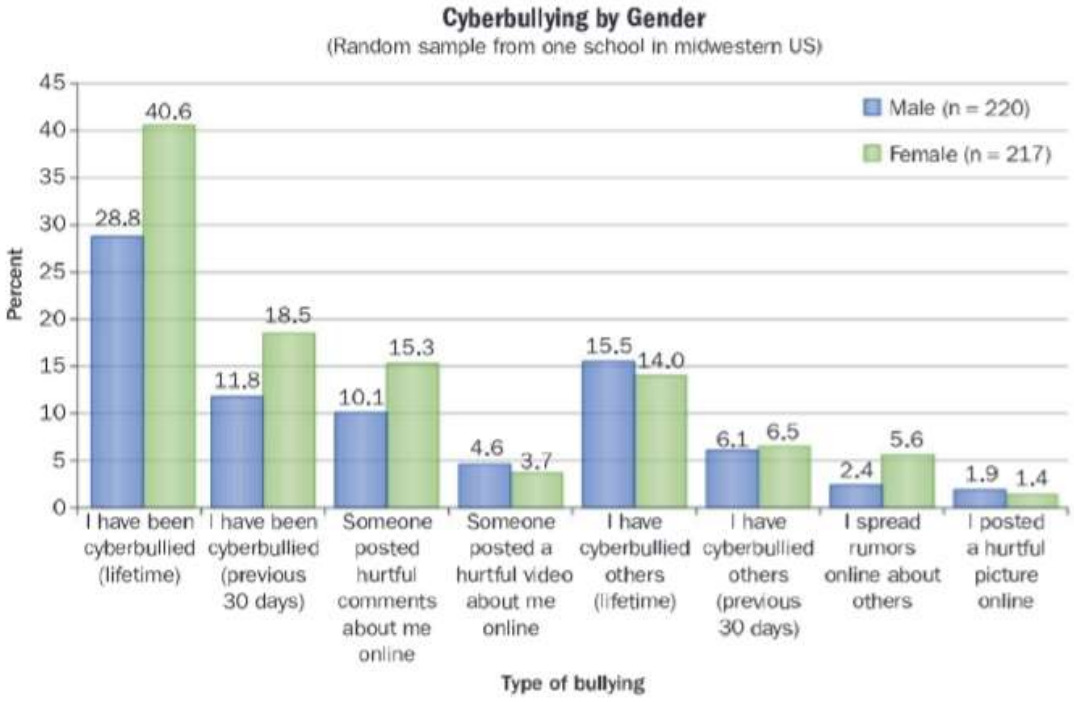


a What kind of data (categorical, ordinal, discrete or continuous) was collected? **Explain** your reasoning.

b What aspects of this graph make it effective? What aspects make it less effective? Give reasons for your answers.

c What does this tell you about youth risk behavior?

3 Data was gathered on cyberbullying in a school.



a What characteristics do you see in this school? **Explain**.

b Why would a pie chart not be an effective way to represent this data?

c Based on the graph, does cyberbullying seem to be a problem in this school? **Justify** your answer.

4 The following was published in a newspaper about the increase in Cooper's hawks in a local community.

store. "In order to find materials that are easily accessible, we're looking for a lot of natural things and recycling."

Cooper's hawk population soars

A deadly combination of shootings and a pesticide, DDT, caused the Cooper's hawk population in Illinois to stay at low levels throughout the 20th century. However, over the past few years, the raptor has made a strong comeback.

SOURCE: NATURAL HISTORY SURVEY — AUSTIN BAIRD THE DAILY ILLINI

Early networking creates more opportunities

a **Explain** how the graph matches the headline.

b What aspects of the graph are misleading or unclear? What would you need to know in order to create a graph that more clearly represented the data?

c **Write down** a new headline for the graph that is more representative of the data.

5 As a class, fill in a copy of this tally chart.

a What type of data (categorical, ordinal, discrete or continuous) was collected?

b **Draw** a bar graph to represent the data.

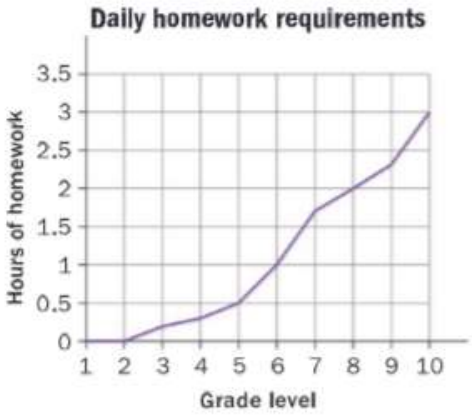
c **Draw** a pie chart to represent the data.

d Which representation is the most effective? **Explain**.

e What characteristics about your class does this reveal?

Hours of homework completed last night	Tally	Frequency
1		
2		
3		
4		
5		
6		

6 A study was done to collect data on the amount of homework required from students at a school in Canada.



a What type of data is 'Grade level'?
What type of data is 'Hours of homework'?

b What is the average amount of homework required daily from a Grade 6 student?

c How much does that increase in Grade 7?

d In what grades are there no homework requirements?

e In what grade are the homework requirements double those in Grade 6?

f Between which two grades is there the greatest increase in homework requirements?

g What is your prediction for the number of hours of homework that a Grade 11 student will have?

h **Explain** why you could not represent this data in a pie chart.

i Should this data be represented in a line graph? **Explain**.

j What would be the most effective way to represent this data? **Draw** the graph using the given data and explain why it is the most effective representation.

7 Year 3 students in a school were asked for their grade in a science class, and about the use of their cell phone in the class.

Frequency of cell phone use per class	Average grade in class (1–7)
0	6.5
1	6.3
2	6.2
3	5.8
4	5.5
5	5.2
6	4.7

a **Draw** two different types of graph to represent the data. **Discuss** the effectiveness of each graph.

b What trends do you see in the data? **Justify** your answer.

c Propose an explanation for the trends you see in the data.

d **Explain** how this data would impact your use of a cell phone in class.

8 The data below represent the participation rate in various sports based on the family's income level.

a **Draw** multiple pie charts to represent the data (one pie chart for each sport).

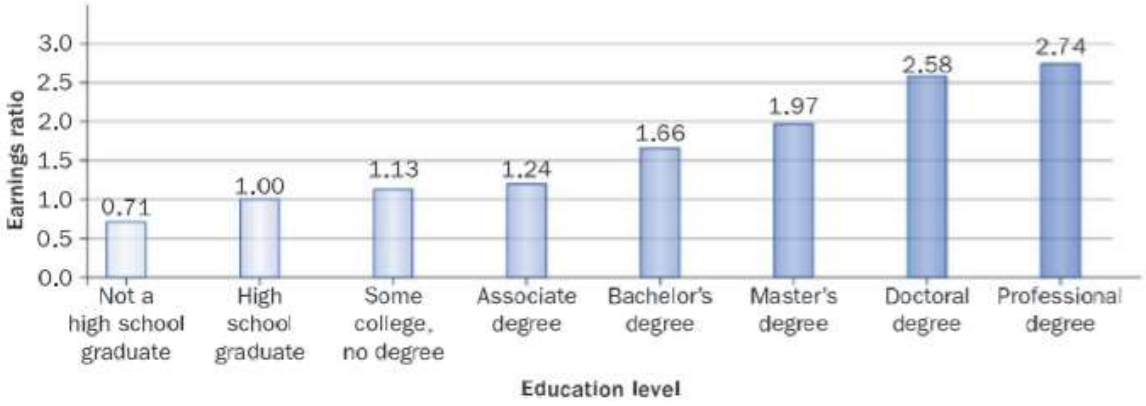
b Which representation do you think is more effective, the original bar graph or the pie charts? **Explain**.

c What characteristic about families do you see in this data? **Justify** your answer.

d Based on the graph, which sport do you think is the most expensive to play? **Explain**.

e How can a community increase participation in sports by families that don't necessarily have the means to afford it?

9 An earnings ratio shows how much someone earns in comparison to a standard. The standard is usually represented by 1.0, so an earnings ratio above 1.0 means earning more than the standard. An earnings ratio less than 1.0 means earning less than the standard. The earnings ratios for a range of education levels are represented in this bar chart.



a Which education level is the standard against which others are compared?

b What information does the graph convey? **Explain** your reasoning.

c How much education would you need in order to earn at least twice as much as a high school graduate?

d Is this the most effective way to represent this data? **Explain**.

10 A study of the number of texts sent per day produced the following data.

Number of texts sent per day	Percentage of teen responses	Percentage of adult responses
0	2%	9%
1 – 10	22%	51%
11 – 20	11%	13%
21 – 50	18%	12%
51 – 100	18%	7%
101 or more	29%	8%

a **Use** technology to represent each column of responses with a circle graph.

b **Use** technology to represent this data using multiple bar graphs.

c Which representation is more effective? **Explain** your answer.

d What characteristics about each age group does this reveal regarding texting? **Explain**.

e **Draw** a graph for how you think the same age groups would have responded ten years ago. **Explain** your graph.

f **Draw** a graph for how you think the same age groups will respond ten years from now. **Explain** your graph.

WEB LINK

You can create a wide range of graphs in Microsoft Excel or Google Sheets.

11 A study collected data on media usage and other elements of life for a group of of 8- to 18-year-olds. The data is represented in the table below.

Media, grades and personal contentment

	I am a heavy user of media	I am a moderate user of media	I am a light user of media
I get good grades	51%	65%	66%
I get fair/poor grades	47%	31%	23%
I have a lot of friends	93%	91%	91%
I get into trouble a lot	33%	21%	16%

a Based on the table, describe characteristics of heavy users of media compared to light users. Does anything surprise you about the data?

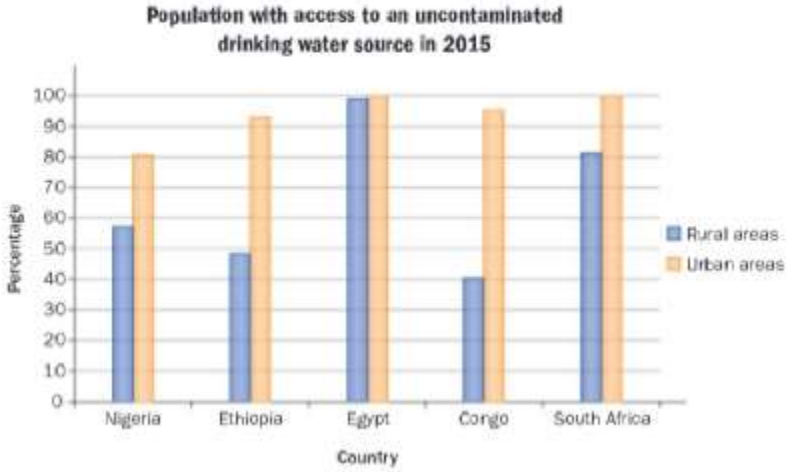
b Create a question that could have been asked to collect the data on students' grades. **Explain** how it is possible that the responses for a media user's grades do not add up to 100 percent.

c Represent this data in a more effective form. **Explain** why that form is more effective.

d Collect the same data from your class. Represent the class data in the most effective form. **Describe** differences between your class data and the data given above.

e Would you change your media usage based on this information? **Explain** your reasoning.

12 The following data is for the five largest African countries by population.



a What is the difference between a rural and an urban area?

b Which country has the lowest percentage of access to safe drinking water in rural areas?

c Which country has the lowest percentage of access to safe drinking water in urban areas?

d Overall, which country has the most access to safe drinking water?

e Represent this data using multiple pie charts. Which representation is more effective? **Explain**.

f If your country is not one of the five in the chart, go to the World Health Organization (who.int), click on 'Data' and look up the world statistics data visualizations dashboard and select 'Drinking water'. Search for your country and compare these results to those of the African countries. Are the percentages higher or lower in your country? Why do you think that is?

ANSWERS

1 **a** Discrete
b The distribution of the dwelling situations for the homeless
c Individual response
d Individual response

2 **a** Discrete
b Individual response
c Individual response

3 **a** Individual response
b Individual response
c Individual response

4 **a** Individual response
b It is not stated what units are used on the vertical axis. The text mentions "the raptor" but it is not clear whether this is. Also, we don't know the population size.
c Individual response

5 **a** Discrete
b Individual response
c Individual response
d Individual response
e Individual response

6 **a** 'Grade level' – ordinal
'Hours of homework' – Discrete
b 1 hour
c Increases by 0.75 hours
d Grades 1 and 2
e Grade 8
f Between grades 6 and 7 or between grades 9 and 10
g Individual response
h Individual response
i Individual response
j Individual response

7 **a** Individual response; can construct different graphs and/or describe them after review
b The students who use their cell phone more frequently in class tend to achieve worse grades (students should use data to support this justification)
c Individual response
d Individual response

8 **a** Pie charts with sectors as follows:
Basketball: Under \$25k = 58°, \$25k – \$49.9k = 76°, \$50k – \$74.9k = 68°, \$75k – \$100k = 54°, Over \$100k = 104°
Soccer: Under \$25k = 47°, \$25k – \$49.9k = 68°, \$50k – \$74.9k = 58°, \$75k – \$100k = 61°, Over \$100k = 126°
Swimming: Under \$25k = 29°, \$25k – \$49.9k = 58°, \$50k – \$74.9k = 43°, \$75k – \$100k = 75°, Over \$100k = 155°
Lacrosse: Under \$25k = 14°, \$25k – \$49.9k = 36°, \$50k – \$74.9k = 58°, \$75k – \$100k = 50°, Over \$100k = 202°
b Individual response
c Individual response
d Individual response (Lacrosse)
e Individual response

9 **a** High School Graduate
b Individual response
c At least a doctoral degree
d Individual response

10 **a** For the teens: circle graph with the following sectors.
0 = 7°, 1–10 = 79°, 11–20 = 40°, 21–50 = 65°, 51–100 = 65°, 101 or more = 104°.
For the adults: circle graph with the following sectors.
0 = 32°, 1–10 = 184°, 11–20 = 47°, 21–50 = 43°, 51–100 = 25°, 101 or more = 29°.
b Individual response
c Individual response
d Individual response
e Individual response
f Individual response

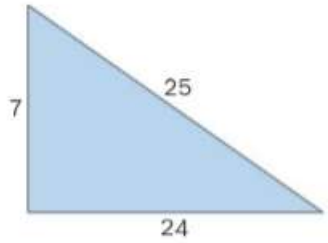
11 **a** Individual response
b Individual response
c Individual response
d Individual response
e Individual response

12 **a** Individual response (An urban area is a densely populated region that is equipped with infrastructure. A rural area is an area that is not considered to be rural.)
b Congo
c Nigeria
d Egypt
e Individual response
Individual response
f Individual response

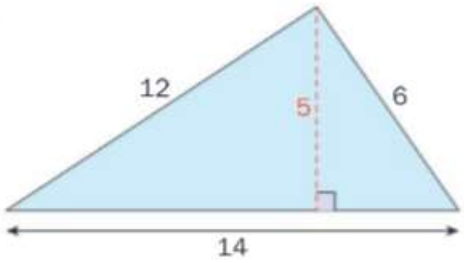
PERIMETER, AREA AND VOLUME

1 Find the perimeter and area of these shapes.
Diagrams are not to scale, and all measurements are in inches.

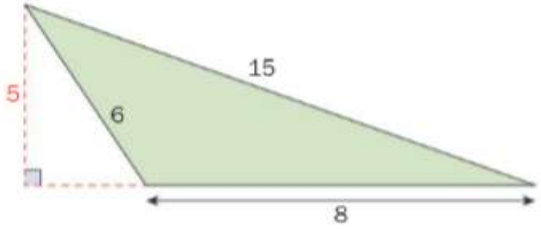
a



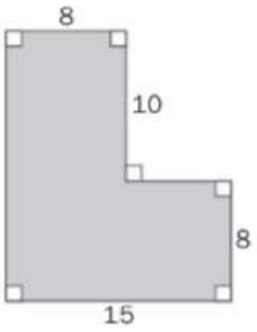
b



c

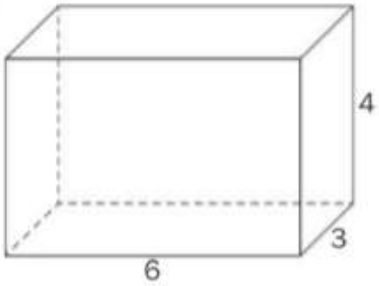


d

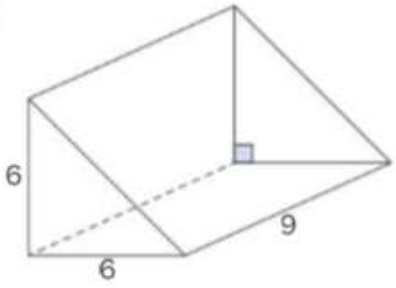


2 Find the volume of these 3D shapes. All measurements are in meters.

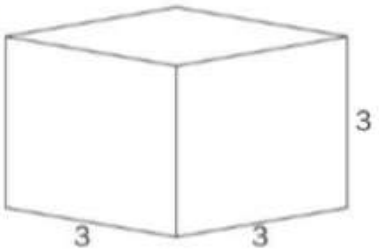
a



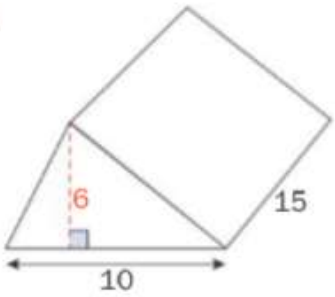
b



c

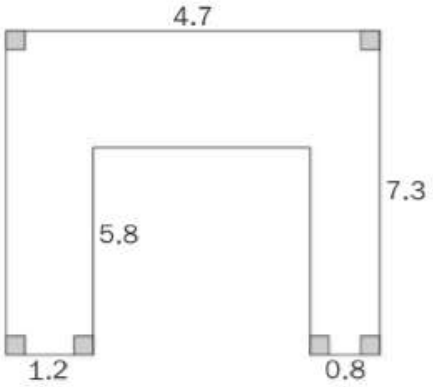


d

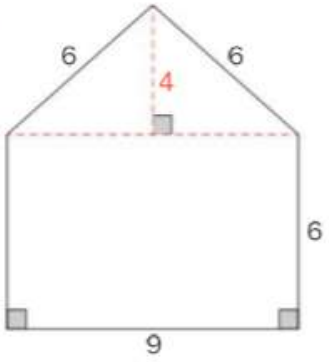


3 Find the perimeter and area of these shapes. Diagrams are not to scale, and all measurements are in centimeters. Round your answers to the nearest hundredth where appropriate.

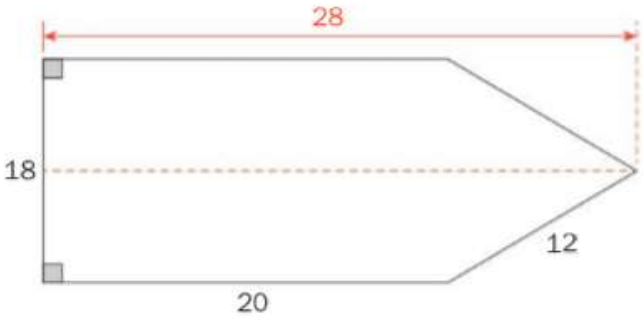
a



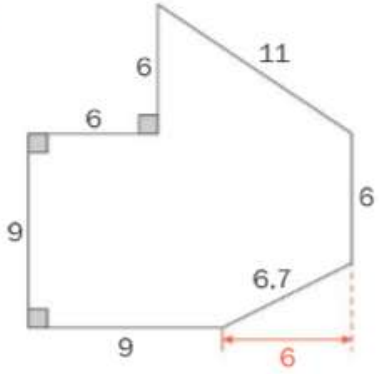
b



c

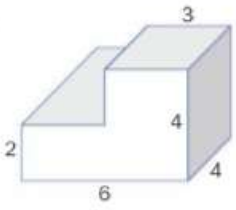


d

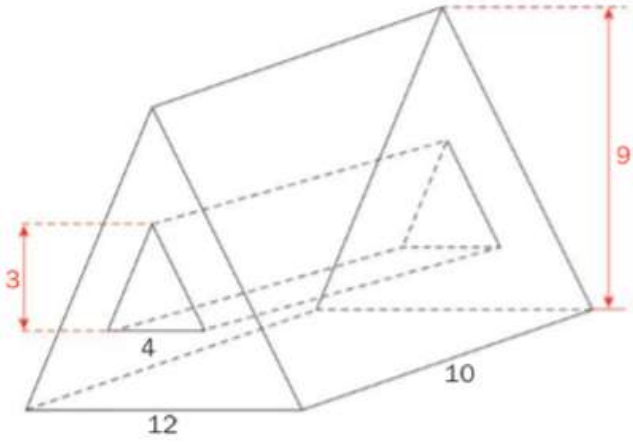


4 Find the volume of these 3D shapes. All measurements are in feet.

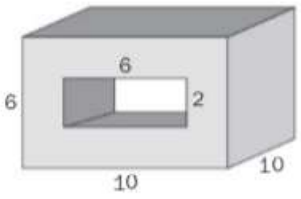
a



b



c



ATL2

5 Each solar panel on the roof below is square, with a side that measures 1.6 m.

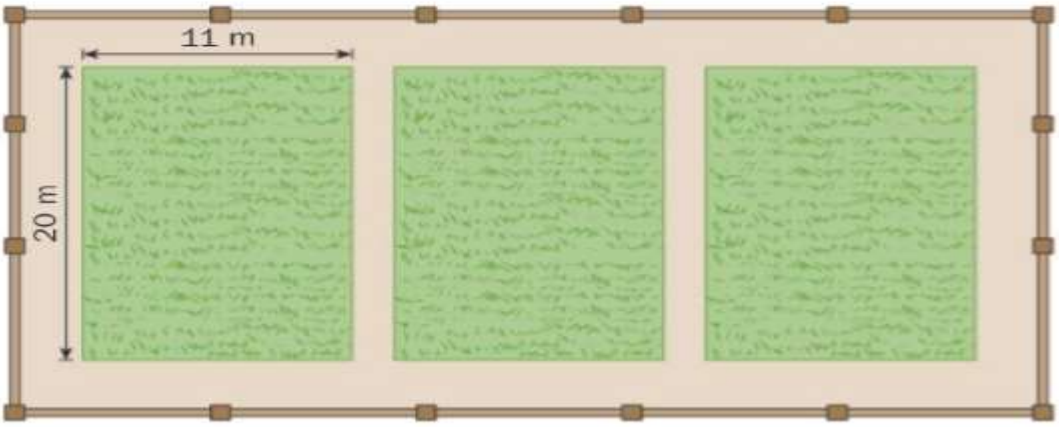
a Find the perimeter and area of the solar panel arrangement.

b Ignoring the geometry of the roof for the moment, design a solar panel arrangement where the area of panels is the same as above, but the perimeter is less than it is now.

c Would your new arrangement fit on the roof in the picture?

d What limitations prevent people from converting to solar power for their energy needs?

6 On a large rectangular plot of land, three sustainable gardens are planted in rectangular sections. Each garden measures 20 m by 11 m. There is a 3 m gap between adjacent plots. There is also a 3 m border between each garden and the overall plot. If you want to fence in the entire rectangular plot, how much fencing will you need?



7 Tiny houses have become popular in the United States as a way of simplifying life, but also of being more ecologically friendly. With a living space of less than 46 m^2, tiny houses use less materials to build, require less energy and can be built on smaller amounts of land. The tiny houses below are two examples of designs from which customers can choose.

The house on the left has interior dimensions of 2.5 m × 18 m × 2.8 m. The triangular house has base dimensions of 4 m × 10 m, maximum height of 7 m and slant height of 7.3 m.

a Find the amount of space inside each house.

b Compare the environmental impacts (positive and negative) of each house.

c If you were building a tiny house, which design would you select? **Explain**.

8 **a** Here is a sketch of some sun screen windows that block ultraviolet light. The two center windows, have parallel sides measuring 4.5 m and 3.5 m, respectively. The bottom (horizontal) side measures 1.5 m. What is the area of one of these center windows?

b The area of each outer window is equal to that of each center window. If the parallel sides of the outer windows measure 2.8 m and 0.4 m, what is the length of the bottom side?

9 The Saskatchewan glacier, in the Columbia icefields of Alberta, Canada, can be approximated by a rectangular prism with a length of 13 km, a width of 2.5 km and a depth of 1 km

a Find the area of the surface of the glacier that is exposed to air. (This is everything except the bottom surface.)

b Find the volume of ice in the glacier.

c If the length, width and depth are all cut in half, how would the volume of ice compare to the current amount? **State** the percentage decrease that this would represent.

d The Saskatchewan glacier is a primary source of water for the North Saskatchewan River, which is part of a major commercial route in Canada, as well as being the site of several hydroelectric dams. What impacts (both positive and negative) could there be from a melting Saskatchewan glacier?

10 Each of these compost bins has a square base, measuring 1 m by 1 m. The front panel is 1.2 m high and the back panel is 1.5 m high.

a **Calculate** the volume of compost the set of three compost bins could hold when filled to capacity.

b Would it be realistic to fill them to capacity? What volume would be a more realistic amount to hold? **Explain** your reasoning.

★ **11** **a** **Show** that a rectangular prism with dimensions $4 \times 6 \times 12$ has a surface area that is numerically equal to its volume.

b There are nine other rectangular prisms with whole number sides that have a surface area numerically equal to their volume, one of which is a cube. Find the dimensions of the cube and one of the other rectangular prisms.

ANSWERS

1 **a** Perimeter: 56 in
Area: 84 in^2
b Perimeter: 32 in
Area: 35 in^2
c Perimeter: 29 in
Area: 20 in^2
d Perimeter: 66 in
Area: 200 in^2

2 **a** 72 m^3 **b** 162 m^3 **c** 27 m^3 **d** 450 m^3

3 **a** Perimeter: 35.6 cm
Area: 18.65 cm^2
b Perimeter: 33 cm
Area: 72 cm^2
c Perimeter: 82.08 cm
Area: 432 cm^2
d Perimeter: 53.7 cm
Area: 153 cm^2

4 **a** 72 $feet^3$ **b** 480 $feet^3$ **c** 480 $feet^3$

5 **a** Perimeter: 57.6 m
Area: 76.8 m^2
b Individual response
c Individual response
d Individual response

6 1224 m^2

7 **a** Volume of left house: 126 m^3
Volume of right house: 140 m^3
b Individual response
c Individual response

8 **a** 6 m^2 **b** 3.75 m

9 **a** 63.5 km^2
b 32.5 km^3
c The new volume would be an eighth of the current volume. This is an 87.5% decrease in the volume
d Individual response

10 **a** 4.05 m^3 **b** 3.6 m^3, Individual response

11 **a** Surface area = $2 \times (4 \times 6 + 4 \times 12 + 6 \times 12) = 288$ $units^2$
Volume = $4 \times 6 \times 12 = 288$ $units^3$
So numerically the surface area and volume are equal
b A cube of side length 6 will have a volume of $6 \times 6 \times 6 = 216$ $units^3$, and a surface area of $2 \times (6 \times 6 + 6 \times 6 + 6 \times 6) = 216$ $units^3$.
One such rectangular prism whose surface area is numerically equal to its volume is one that measures $4 \times 6 \times 12$.