SKILL 1: Fractions

Example 1:

In a care home, $\frac{3}{8}$ of the residents chose pasta for their lunch and $\frac{1}{6}$ chose soup. The rest chose baked potato. How many chose baked potato?

$$\frac{3}{8} + \frac{1}{6} = \frac{9}{24} + \frac{4}{24} = \frac{13}{24}$$

$$1 - \frac{13}{24} = \frac{24}{24} - \frac{13}{24} = \frac{11}{24}$$

Example 2: Non-calculator

Grandpa Joe left 30% of his savings of £2150 to his favourite grandson Kevin.

Kevin's friend Grant also received an inheritance from his late father, who left him $\frac{4}{5}$ of his total savings of £762. Who received more money?

Kevin - 30% of 2150 = $\frac{3}{10}$ of 2150 = 215

215 × 3

£645

Grant - $\frac{4}{5}$ of 762 = 762 ÷ 5 × 4

$$5\overline{)762.^{2}0} = 152.4$$

152.4 × 4

£609.6

Kevin got more as £645 > £609.60

1. A basic cookie dough mix requires butter, sugar, flour and chocolate chips.

- $\frac{1}{6}$ of the mix is butter
- $\frac{1}{3}$ of the mix is sugar
- $\frac{1}{4}$ of the mix is chocolate chips
- The rest of the mix is flour

Calculate the fraction of the mix that is flour.

2. A class of pupils were asked about how they travelled to school on a particular day.

- $\frac{1}{6}$ of the pupils were driven to school in a car.
- $\frac{2}{5}$ of the pupils took the bus.
- The rest of the pupils walked to school.

Calculate the fraction of pupils who walked to school.

3. Guests at a wedding were asked to choose their main course.

- $\frac{3}{7}$ of the guests chose chicken
- $\frac{1}{3}$ of the guests chose beef
- the remaining guests chose the vegetarian option.

Calculate the fraction of guests that chose the vegetarian option.

4. Dave and Elaine each have the same monthly data allowance on their mobile phone contract.

Dave has used $\frac{4}{7}$ of his monthly data allowance.

Elaine has used $\frac{5}{8}$ of her monthly data allowance.

Who has used the most data?

Give a reason for your answer.

Answers

1) $\frac{1}{4}$ **2)** $\frac{13}{30}$ **3)** $\frac{5}{21}$ **4) Since** $\frac{4}{7} = \frac{32}{56}$ **and** $\frac{5}{8} = \frac{35}{56}$ **Elaine has used more.**

SKILL 2: Compound Percentages

appreciation and depreciation

(1) A £240 000 house appreciates in value by 5% in 2007, appreciates 10% in 2008 and depreciates by 15% in 2009. Calculate the value of the house at the end of 2009.

or *evaluate year by year*

5% *increase*: 100% + 5% = 105% = 1·05

10% *increase*: 100% + 10% = 110% = 1·10

15% *decrease*: 100% – 15% = 085% = 0·85

£240000 × 1·05 × 1·10 × 0·85

= £235620

year 1

5% *of* £240000 = £12000

£240000 + £12000 = £25200

year 2

10% *of* £252000 = £25200

£252000 + £25200 = £277200

year 3

15% *of* £277200 = £41580

£277200 – £41580 = £235620

compound interest

(2) Calculate the compound interest on £12000 invested at 5% pa for 3 years.

£12000 × $(1·05)^3$ *ie.* × 1·05 × 1·05 × 1·05 *or evaluate year by year*

£12000 × 1·157625

= £13891·50

compound interest = £13891·50 – £12000 = £1891·50

Questions

1 (C) Jack weighs 94 kilograms.

On the 1st of January, he starts a diet which is designed to reduce his weight by 7% per month.

During which month should he achieve his target weight of 73 kilograms?

Show all your working. **4 marks**

2 (C) There are 2·69 million vehicles in Scotland.

It is estimated that this number will increase at a rate of 4% each year.

If this estimate is correct, how many vehicles will there be in 3 years' time?

Give your answer **correct to 3 significant figures.** **4 marks**

3 (C) Olga normally runs a total distance of 28 miles per week.

She decides to increase her distance by 10% a week for the next four weeks.

How many miles will she run in the fourth week? **3 marks**

4 (C) A company buys machinery worth £750 000.

The value of the machinery depreciates by 20% per annum.

The machinery will be replaced at the end of the year in which its value falls below half of its original value.

After how many years should the machinery be replaced?

You must explain your answer. **4 marks**

5 (C) Due to the threat of global warming, scientists recommended in 2010 that the emissions of greenhouse gases should be reduced by 50% by the year 2050.

The government decided to reduce the emissions of greenhouse gases by 15% **every ten years**, starting in the year 2010.

Will the scientists' recommendations have been achieved by 2050?

You must give a reason for your answer.

4 marks

6 (C) It is estimated that house prices will increase at the rate of 3·15% per annum.

A house is valued at £134 750. If its value increases at the predicted rate, calculate its value after 3 years.

Give your answer correct to **four** significant figures.

4 marks

7 (C) It is estimated that an iceberg weighs 84 000 tonnes.

As the iceberg moves into warmer water, its weight decreases by 25% each day.

What will the iceberg weigh after 3 days in the warmer water?

Give your answer **correct to three significant figures.**

4 marks

8 (C) A company makes large bags of crisps which contain 90 grams of fat.

The company aims to reduce the fat content of the crisps by 50%.

They decide to reduce the fat content by 20% each year.

Will they have achieved their aim by the end of the 3rd year?

Justify your answer.

4 marks

9 (C) An industrial machine costs £176 500.

Its value depreciates by 4·25% each year.

How much is it worth after 3 years?

Give your answer correct to **three** significant figures.

4 marks

10 (c) Jack bought a car 3 years ago costing £1400.

The car has decreased in value by 13% each year.

(a) Calculate the current value of the car.

Give your answer to **2 significant figures.**

Jack sells his car for £950.

(b) Calculate his loss as a percentage of the **original price.**

Answers

1) During April
2) 3.03 million
3) 40.9948 miles
4) 4 years because 307 200 < 375 000
5) No, 0.522 > 0.5
6) £147 900
7) 35 400 tonnes
8) No, because 51.2% > 50%
9) £155 000
10a) £920 b) 32% loss

SKILL 3: Standard Deviation

STANDARD DEVIATION

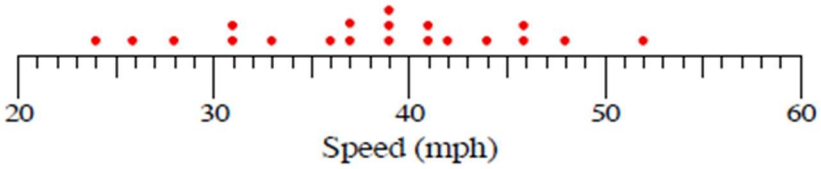
A measure of the spread of a set of data, giving a numerical value to how the data deviates from the mean. It therefore gives an indication of how good the mean is as a representitive of the data set.

Formulae:

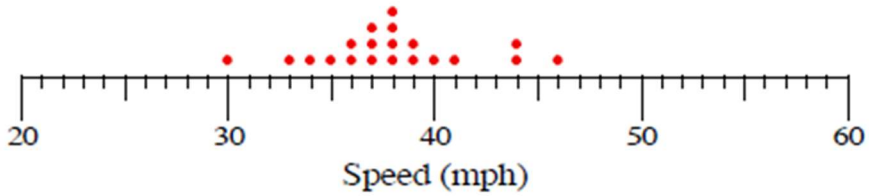
mean $\bar{x} = \dfrac{\sum x}{n}$ standard deviation $s = \sqrt{\dfrac{\sum (x-\bar{x})^2}{n-1}}$ or $s = \sqrt{\dfrac{\sum x^2 - \dfrac{(\sum x)^2}{n}}{n-1}}$

Examples,

(1) High Standard Deviation: results spread out mean = 38 , standard deviation = 7·5



(2) Low Standard Deviation: results clustered around the mean
the results are more consistent mean = 38 , standard deviation = 3·8



The pulse rates of 8 army recruits: 61, 64, 65, 67, 70, 72, 75, 78 beats per minute.

$\bar{x} = \dfrac{\sum x}{n}$

$= \dfrac{552}{8}$

$= 69$

	x	$x-\bar{x}$	$(x-\bar{x})^2$
	61	-8	64
	64	-5	25
	65	-4	16
	67	-2	4
	70	+1	1
	72	+3	9
	75	+6	36
	78	+9	81
TOTALS	552		236

$s = \sqrt{\dfrac{\sum (x-\bar{x})^2}{n-1}}$

$= \sqrt{\dfrac{236}{7}}$

$= 5 \cdot 806....$

$\approx 5 \cdot 8$

Questions

1 Harry often plays golf and the scores for some of his games are recorded below.

84 78 87 80 81

(*a*) For this sample calculate:

(i) the mean; **1 mark**

(ii) the standard deviation. **3 marks**

Show clearly all your working.

(*b*) His partner for these games is Tony, whose scores are listed below.

104 98 107 100 101

Write down the mean and standard deviation of Tony's scores. **2 marks**

2 A ten-pin bowling team recorded the following six scores in a match.

134 102 127 98 104 131

(*a*) For this sample calculate:

(i) the mean;

(ii) the standard deviation.

Show clearly all your working. **4 marks**

In their second match their six scores have a mean of 116 and a standard deviation of 12·2.

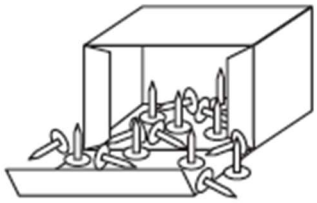
(*b*) Consider the 5 statements written below.

1 The total of the scores is the same in both matches.
2 The total of the scores is greater in the first match.
3 The total of the scores is greater in the second match.
4 In the first match the scores are more spread out.
5 In the second match the scores are more spread out.

Which of these statements is/are true? **2 marks**

3 A sample of six boxes contains the following numbers of pins per box.

43 39 41 40 39 44



(*a*) For the above data, calculate: **1 mark**

(i) the mean;

(ii) the standard deviation. **3 marks**

The company which produces the pins claims that "the mean number of pins per box is 40 ± 2 and the standard deviation is less than 3".

(*b*) Does the data in part (*a*) support the claim made by the company?

Give reasons for your answer. **2 marks**

4 A machine is used to put drawing pins into boxes.

A sample of 8 boxes is taken and the number of drawing pins in each is counted.

The results are shown below:

102 102 101 98 99 101 103 102

(*a*) Calculate the mean and standard deviation of this sample. **3 marks**

(*b*) A sample of 8 boxes is taken from another machine.

This sample has a mean of 103 and a standard deviation of 2·1.

Write down two valid comparisons between the samples. **2 marks**

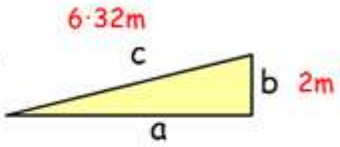
Answers

1) (a) 82 (b) s = 3.54 (c) Mean = 102, s = 3.54
2) (a) (i) 116 (ii) 16.33 (b) 1 and 4
3) (a) 41 (b) s = 2.1 (c) Yes, with two statements comparing values
4) (a) mean = 101, s = 1.69 (b) comparison involving 'average' and 'spread/consistency

SKILL 4: Gradient/Pythagoras Theorem

Example: To pass Health & Safety regulations a supermarket ramp must not exceed a gradient of 0·4.

Does this ramp meet requirements ?



First we need to find the horizontal distance.

$a^2 = c^2 - b^2$

$a^2 = 6{\cdot}32^2 - 2^2$

$a^2 = 35{\cdot}94$

$a = \sqrt{35{\cdot}94}$

$a \approx 6$ m

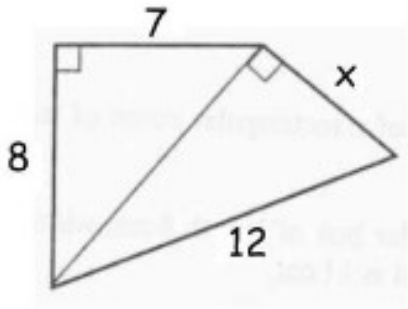
$m = \frac{V}{H}$

$= \frac{2}{6}$

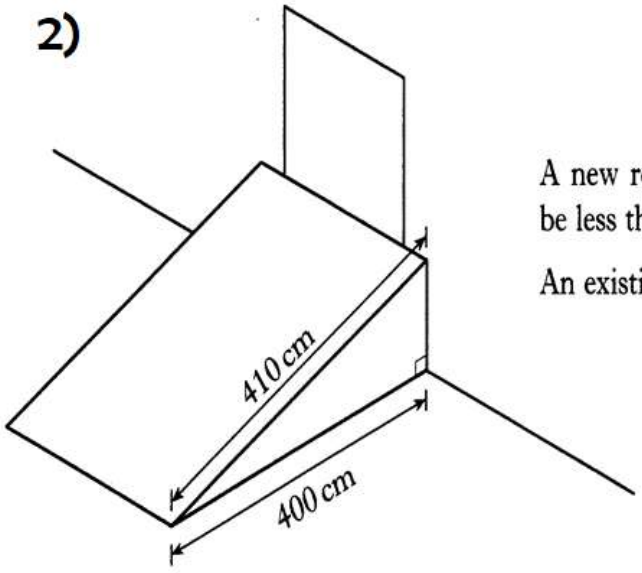
$= 0{\cdot}33$

Conclusion: Yes it does meet the requirements as 0.33 < 0.4!

1) Find the length marked x in the diagram below



2)



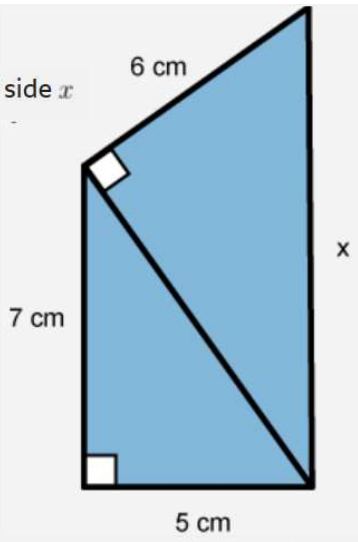
A new regulation states that the gradient of all ramps into a building must be less than 0·26.

An existing ramp is 410 cm long and has a horizontal distance of 400 cm.

Does this ramp satisfy the new regulation?

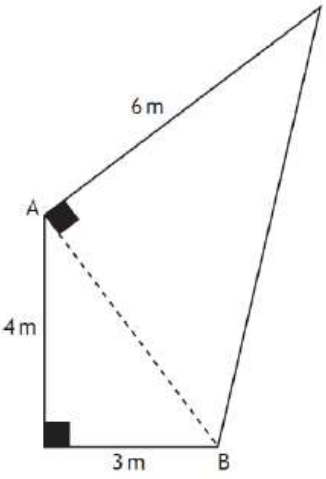
Show all your working and give a reason for your answer.

3) Calculate the length of side x

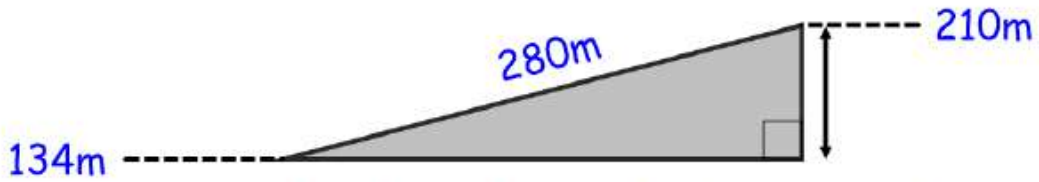


4) Non-calculator The diagram shows a patio in the shape of two right-angled triangles.

a) Calculate the length AB. **(3)**
b) Calculate the area of the patio. **(2)**
c) Another larger patio is made. The ratio of the dimensions of the larger patio to the dimensions of the smaller patio is 5:2. How long is side AB in the larger patio?



5) Calculator Blacklight Hill is 210 metres high. A road going up the hill has length 280m.



Dylan's car cannot climb roads with a gradient higher than 0·3. Can Dylan's car climb this hill? **Explain your answer. (4)**

6) Calculator A wheelchair ramp is designed to a specification. The specification says that it must have a gradient of $0.1 \pm 5\%$.

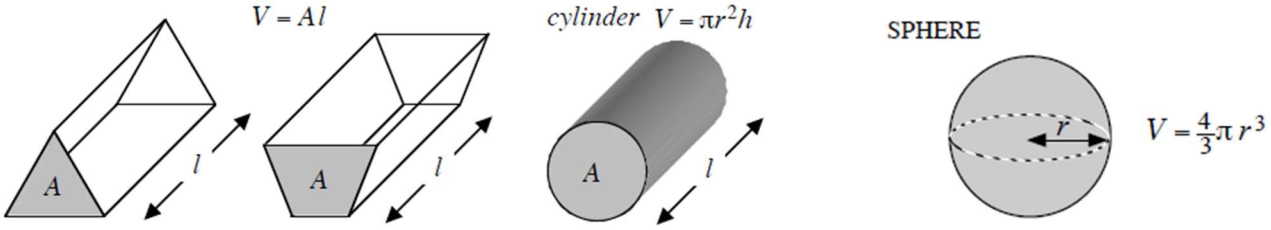
When a prototype is checked it is found to have a run of 1· 2 metres and a rise of 17cm. Does the ramp meet the specification? **Explain your answer. (4)**

Answers

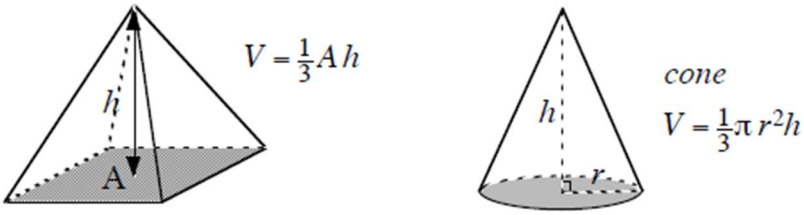
1) 5.57 2) height= 90, gradient = 0.225 so yes its ok as 0.225 < 0.26 3)10.5cm
4a) 5m b) 21m^2 c) 12.5m 5) length = 269.5, gradient = 0.28 so yes as 0.28< 0.3
6) Any gradient between 0.095 & 0.105 is ok. It's 0.14 so does not meet the specification

SKILL 5: Volume

PRISMS a solid with the same cross-section throughout its length.
length l is at right-angles to the area A.

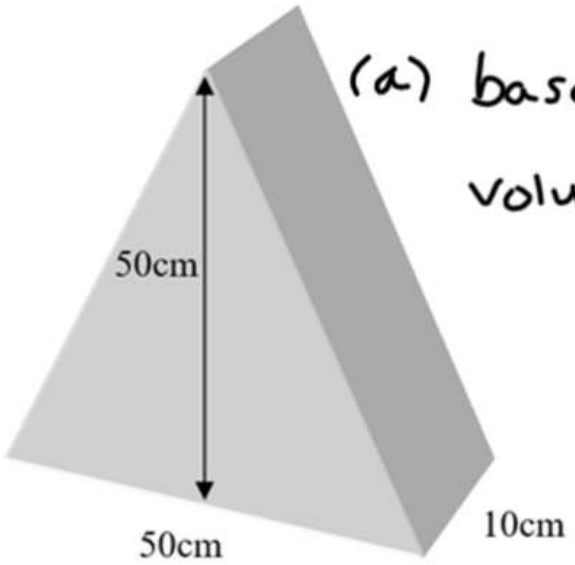


PYRAMIDS



Example

a) Calculate the volume of the world's largest Toblerone piece shown below:



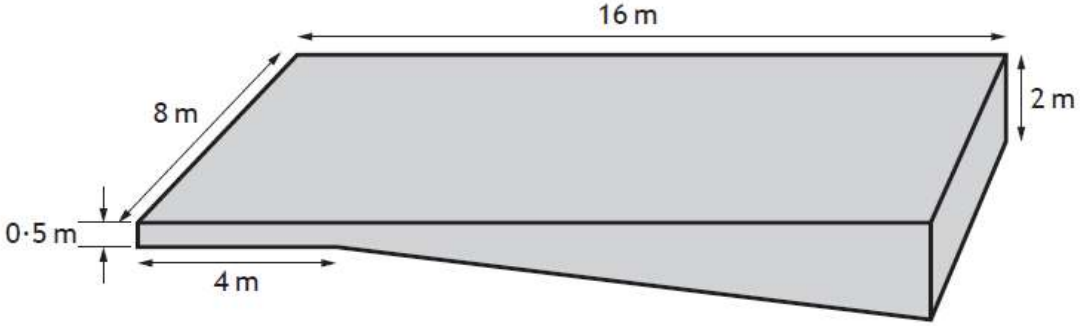
(a) base area = $\frac{1}{2}$ 50×50 = 1250 cm²

volume = base area × 10
= 12500cm³

(b) 12500 ÷ 1000
= 12.5 litres

b) How many litres of chocolate are needed to make the piece?

1. The swimming pool is a prism, with dimensions as shown in the diagram below.

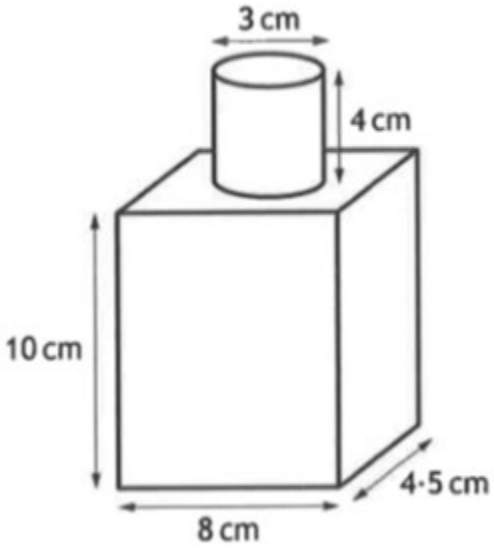


Calculate the volume of the swimming pool.

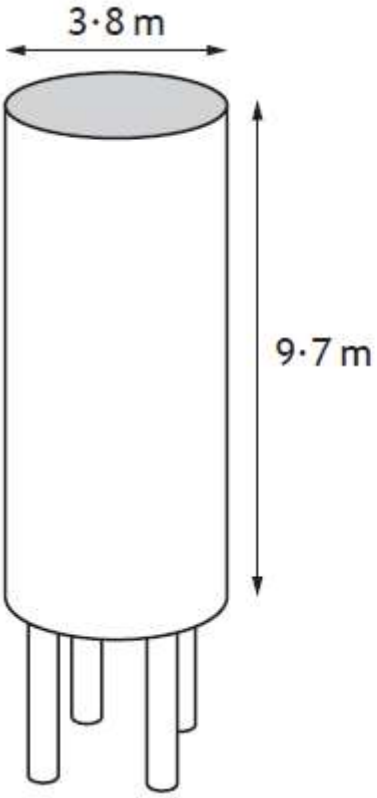
Give your answer **in litres.**

2.

A bottle consists of a cuboid and a cylinder.
The dimensions are shown in the diagram.
Calculate the volume of the bottle.



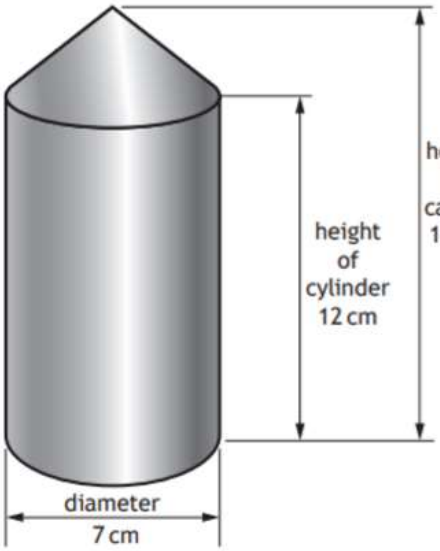
3.



The storage container for the sheep food is in the shape of a cylinder, with dimensions as shown below.

Calculate the volume of the storage container.

4) Brendan also makes blue candles in the shape of a cylinder with a cone on top as shown.

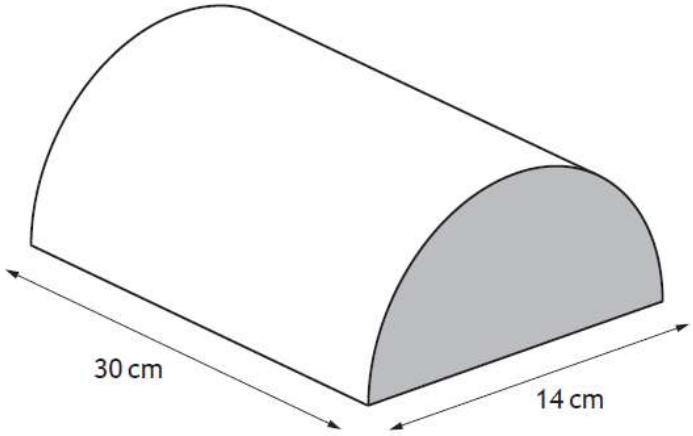


(c) He buys blue wax in blocks with volume 12 000 cm^3.
Brendan thinks that he can make 25 of these candles from one block of wax.
Is he correct?
Use your working to justify your answer.

5. The Victorians used stoneware hot water bottles.

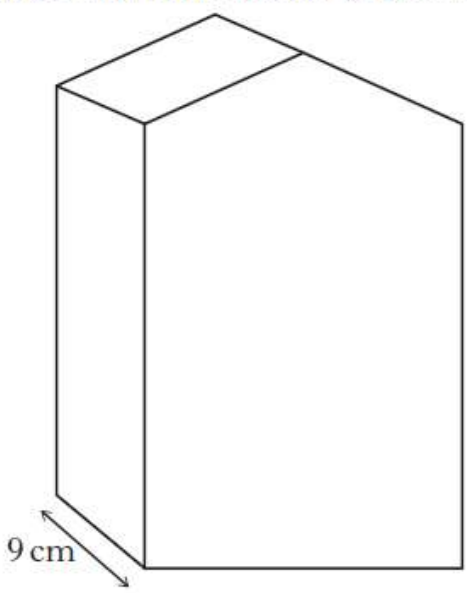
They were semi-circular prisms as shown.

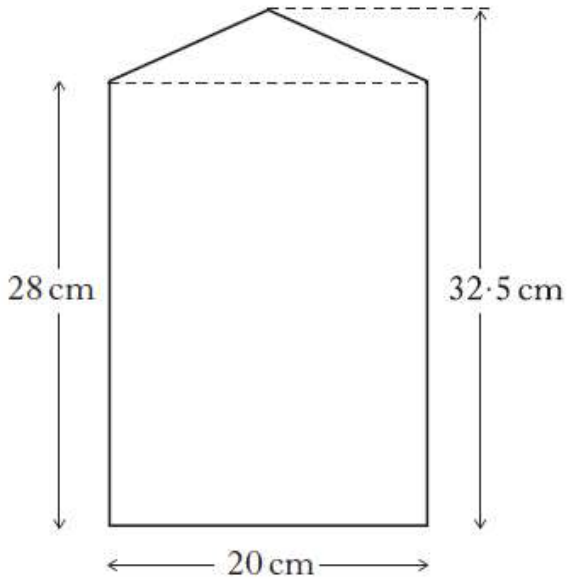
The diameter of the bottle is 14 cm and the length is 30 cm.



Calculate the volume of the hot water bottle.

6. A container for oil is in the shape of a prism. The width of the container is 9 centimetres. The uniform cross section of the container consists of a rectangle and a triangle with dimensions as shown.





Calculate the volume of the container, **correct to the nearest litre.**

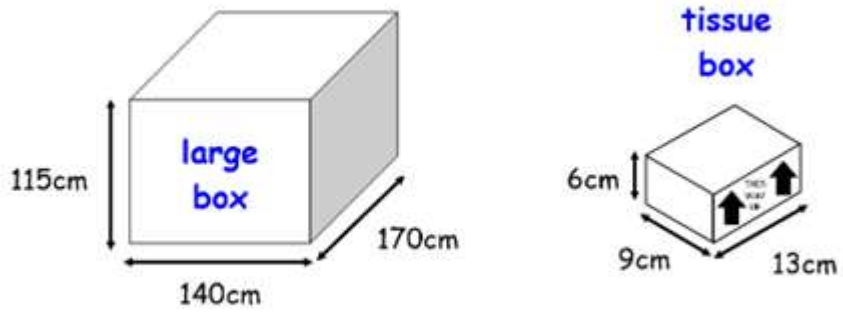
Answers

1) 136000 litres
2) 388.3cm^3
3) 110m^3
4) v = 513.1cm^3 => 12000 ÷ 513.1 = 23.3 so yes can make 25
5) 2309.1cm^3
6) 5445cm^3 => 5 litres

SKILL 6: Container Packing

Example:

Tissue boxes measuring 13cm by 9cm by 6cm are being packed into a larger box measuring 115cm by 140cm by 170cm as shown in the diagram.



The boxes must be packed upright so the tissues stay in a neat pile. What is the maximum number of tissue boxes that can be packed into the larger box?

option ①

$140 \div 13 = 10.7\ldots$ so 10 only along

$170 \div 9 = 18.8\ldots$ so only 18 diagonally

$115 \div 6 = 19.1\ldots$ So only 19 up

total $= 10 \times 18 \times 19 = 3420$

option ②

$140 \div 9 = 15.5\ldots$ so 15

$170 \div 13 = 13.07\ldots$ So 13

$115 \div 6 = 19$ up

total $= 15 \times 13 \times 19 = 3705$

3705 is the maximum

1. Russell is a lorry driver for a mail delivery company.

The mail is packed into cages which are then loaded on to the lorry.

His lorry has two levels for fitting cages.

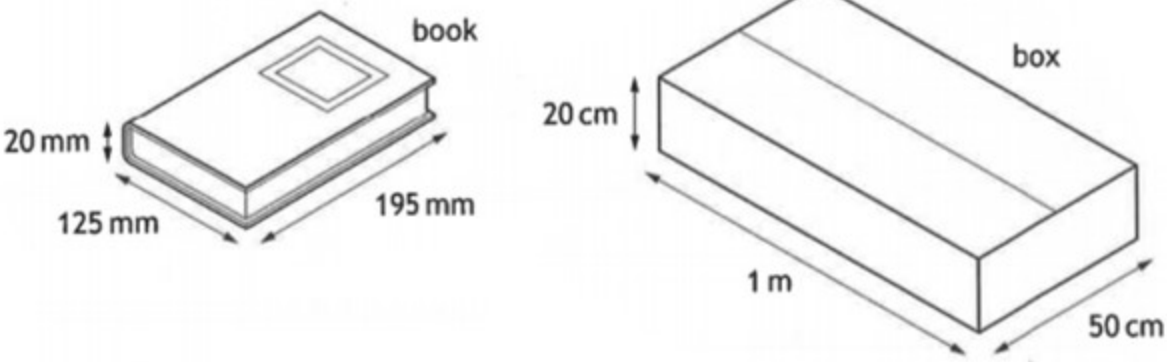
Each cage has wheels on the bottom and must always be **loaded upright**.

The dimensions of the cage and the internal dimensions of the back of the lorry are shown in the diagrams.

What is the maximum number of cages that can be loaded into the back of the lorry?

2. The books are to be packed in boxes for transporting to the bookshops.

The dimensions of the book and the internal dimensions of the box are shown in the diagrams.



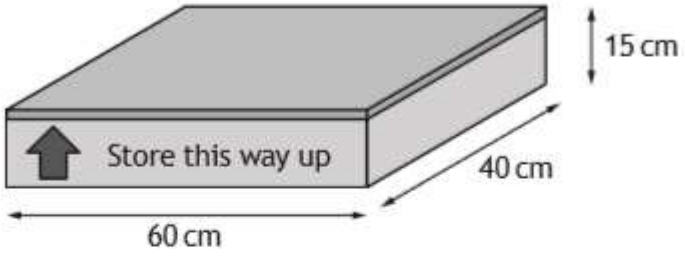
The books need to be laid with the front cover facing upwards in the boxes.

They must all be aligned in the same direction.

(c) Calculate the maximum number of books that can be packed into each box.

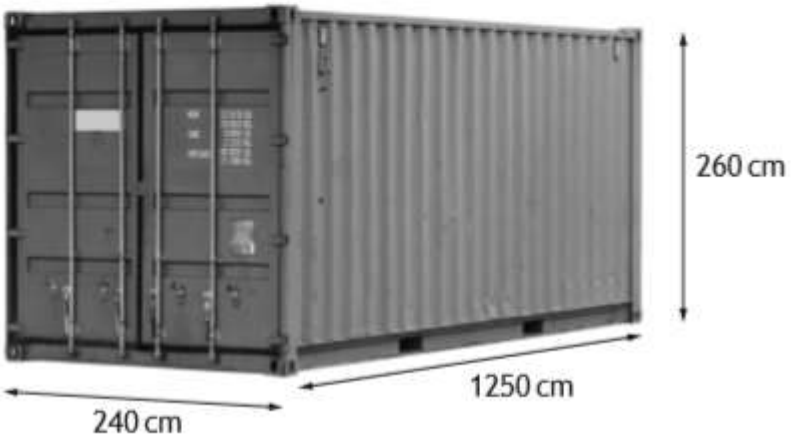
3. The tins are packed in boxes.

Each box has dimensions 60 cm × 40 cm × 15 cm as shown below.



The boxes must be packed into containers for shipping to Canada.

The container has the internal dimensions shown below.

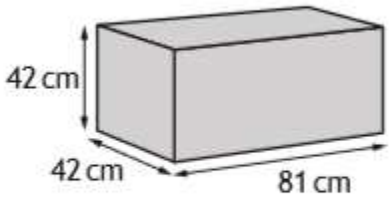


All the boxes must be aligned in the same direction.

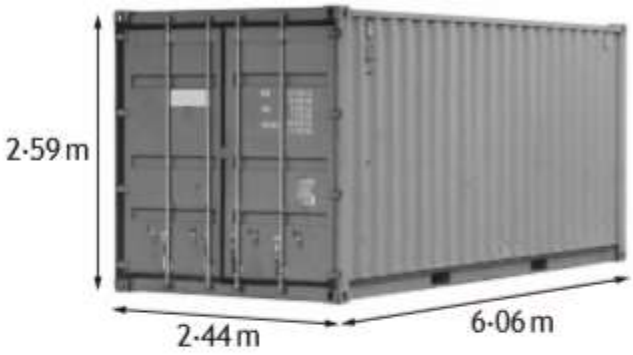
Calculate the maximum number of boxes that will fit in the container.

4. Donna makes tartan handbags.

She puts the bags into boxes. The boxes have the dimensions shown below.



Donna exports her handbags to the USA in a container. The container has the internal dimensions shown below.



All the boxes must be aligned in the same direction.

(a) Calculate the maximum number of boxes that can fit in the container.

Use your working to justify your answer.

Answers

1. 2·25m ÷ 0·75 = 3 cages
15m ÷ 0·85 = 17 cages
Total = 3 x 17 × 2 = 102 cages

2·25m ÷ 0·85 = 2 cages
15m ÷ 0·75 = 20 cages exactly
Total = 20 x 2 ×2 = 80

2. evidence of the two **correct** ways of packing with the front cover facing upwards

$100 \div 12 \cdot 5 = 8$
$50 \div 19 \cdot 5 = 2 \cdot 56\ldots$
$20 \div 2 = 10$
$2 \times 8 \times 10 = 160$

and

$100 \div 19 \cdot 5 = 5 \cdot 12\ldots$
$50 \div 12 \cdot 5 = 4$
$20 \div 2 = 10$
$5 \times 4 \times 10 = 200$

Maximum - 200 books

3. Evidence of the two **correct** ways of packing

$240 \div 60 = 4$
$1250 \div 40 = 31 \cdot 25$
$260 \div 15 = 17 \cdot 3\ldots$
$17 \times 31 \times 4 = 2108$

$240 \div 40 = 6$
$1250 \div 60 = 20 \cdot 83\ldots$
$260 \div 15 = 17 \cdot 3\ldots$
$17 \times 6 \times 20 = 2040$

Maximum – 2108 boxes

4. 252 boxes

SKILL 7: Money Matters (Income, Expenditure and Banking)

Example 1 (calculator):

Fiona is a vet.

She has started a new job.

Her new salary is £42 000.

National Insurance is calculated on a person's salary **before** deductions such as pension contributions.

National Insurance rates	
Up to £8164	0%
From £8164 to £45 032	12%
Over £45 032	2%

(a) (i) Calculate Fiona's annual National Insurance payment.

Fiona's annual income tax payment is £5427·96.

She pays an annual contribution of £3360 into her pension.

Fiona is paid in 12 equal monthly payments.

(ii) Calculate Fiona's monthly net pay.

Fiona plans to rent accommodation.

She needs to work out how much she can afford to spend on rent, electricity and council tax.

The table shows her monthly outgoings.

	Outgoings
Car payment	395
Car insurance	28
Road tax	12
Food	380
Clothes	130
Mobile phone	64
Internet	55
Socialising	250
Loan	200
Savings	200
Total	1714

(b) Calculate how much she will have available per month for rent, electricity and council tax.

Answer

a(i) $42000 - 8164$ (0% rate) $= 33836$

12% of $33836 = £4060.32$

a(ii) $42000 - 5427.96 - 4060.32 - 3360$

$= 29151.72$

$29151.72 \div 12 = £2429.31$

b) $2429.31 - 1714 = £715.31$

Example 2 (non-calculator):

Allana takes out a loan of £4500.

The interest plus the administration fee is 7·5% of the loan amount.

The total amount will be paid back in 9 equal monthly payments.

Calculate the monthly payment.

7.5% of 4500 = 4500 ÷ 100 × 7.5

= 45 × 7.5

= 337.5

45 × 75 → 225, 3150, 3375

4500 + 337.5 = £4837.50

9 ⟌ 4837.5 = £537.50

1. Jill earns £24 300 per annum.

She has a personal tax allowance of £8130.

She pays tax at the basic rate of 20%.

(a) Calculate how much tax she must pay each year.

(b) Jill also pays £166·08 **per month** in National Insurance and £100 **per month** into her pension.

(i) Calculate Jill's **total monthly** deductions.

(ii) Calculate Jill's **monthly** take home pay.

2. Seonaid is saving up to buy a tablet computer costing £388.

She earns £7·30 per hour and works for 30 hours each week.

Seonaid is paid at the end of each week.

She pays £5·32 in Income Tax and £7·68 in National Insurance each week.

Her living expenses are £86 per week.

Seonaid saves **half** of the money that she has left each week towards the tablet computer.

How many weeks will it take her to save up enough money to buy the computer?

3. Adam works for 40 hours per week as a tractor driver on a farm.

His basic wage is £7·40 per hour.

Each week he pays £28·43 Income Tax and £8·57 in National Insurance.

(a) Calculate his take home pay.

(b) Adam is going on holiday in 13 weeks.

The holiday costs £320 and Adam wants to take £200 spending money.

He makes a table to show his weekly income and outgoings.

He puts the balance into his holiday fund.

	Income	Outgoings
Take home pay		
Rent		£76
Bills		£41
Food		£45
Entertainment		£30
Transport		£23
Holiday Fund		

Will he have enough to cover the cost of the holiday and his spending money?

Justify your answer.

4. Anna works as a sales person for a computer company.

She is paid a basic monthly salary of £2450 plus commission of 2·5% on her monthly sales over £3000.

(a) Calculate Anna's gross salary for April when her sales totalled £9000.

In her April payslip, she has the following deductions:

- Income Tax £334·67
- National Insurance £230·20
- Pension £164·74

(b) Calculate her net salary for April.

5. Grace works for a company selling fitted kitchens.

She is paid a basic monthly salary of £500.

She also receives 5% commission on all her sales **above** £8000.

In January Grace sells £23 000 of goods.

Her monthly deductions are 12% of her gross income.

Grace writes down her budget for the month.

Rent	£245
Bills	£198
Food	£164
Entertaining	£75

Grace saves any surplus.

(a) Calculate Grace's **net** pay for January.

(b) Calculate the surplus that Grace will have for January.

(c) To buy a car Grace needs to borrow £4500.

She wants to repay the loan **as soon as possible**.

She investigates the cost of the loan from five different lenders.

The table shows the repayments for a £4500 loan.

Lender	12 months	24 months	36 months
Tasko	£413·86	£215·07	£150·60
Bank of Shapes	£418·54	£219·31	£157·42
TMS	£458·83	£260·59	£197·74
Premier Bank	£422·46	£214·74	£159·21
Free Bank	£432·99	£234·15	£170·09

Grace assumes that she will earn the same commission each month.

Calculate her **new monthly surplus** and determine from which lender she should take her loan, and over how many months.

6. Orla and Mark want a new kitchen.

They investigate various options to borrow the money they need and to pay it back **in one year**. The following information is what they found out.

The best rates for fixed amounts are from EasyBank as shown in the table below.

Loan Amount	£2500		£5000		£10 000	
Interest per year	17%		14·6%		12·26%	
Repayment terms over 1 year	Monthly	Total	Monthly	Total	Monthly	Total
	£243·75	**A**	£477·50	£5730	**B**	£11 226

(a) What is the total repayment **(A)** on a loan of £2500 from EasyBank?

(b) What is the monthly repayment **(B)** on a loan of £10 000 from EasyBank?

(c) Calculate the difference in total repayments between Orla and Mark taking out a loan of £5000 each, compared with a single loan of £10 000 from EasyBank.

(d) Orla and Mark also consider using a home improvement loan from a finance company to buy a kitchen. The finance company charges 27·5% simple interest on the loan amount. Calculate the total amount to be repaid for a loan of £5000.

Answers

1.a) £3234 b) (i) £535.58 (ii) £1489.42

2. 7 weeks

3. a) £259 b) holiday cost = £520, holiday fund = £572 so yes can save £52 extra

4.a) £2600 b) 1870.39

5.a) £1100 b) £418 c) Premier Bank, 24 months

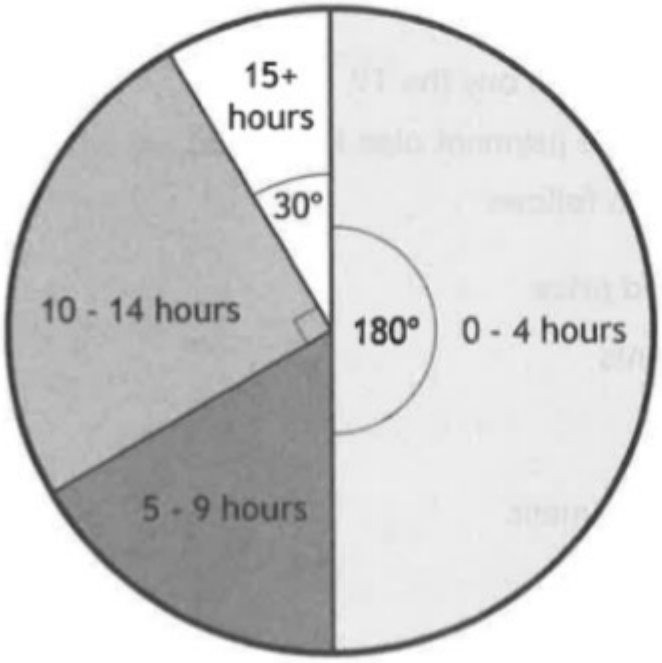
6.a) A = £2925 b) £935.50 c) £234 d) £6375

Skill 8: Statistical Diagrams

PIE CHART

Example:

The pie chart shows the number of hours overtime that 72 employees of a supermarket worked during one month.



(a) Calculate how many employees worked 15+ hours overtime.

(b) Calculate the probability that an employee chosen at random worked 9 or less hours overtime.

(a) $\frac{30}{360} \times 72 = \frac{1}{12} \times 72 = 6$

(b) 15+ hours = 6 people

10–14 hours = $\frac{1}{4}$ of 72 = 18

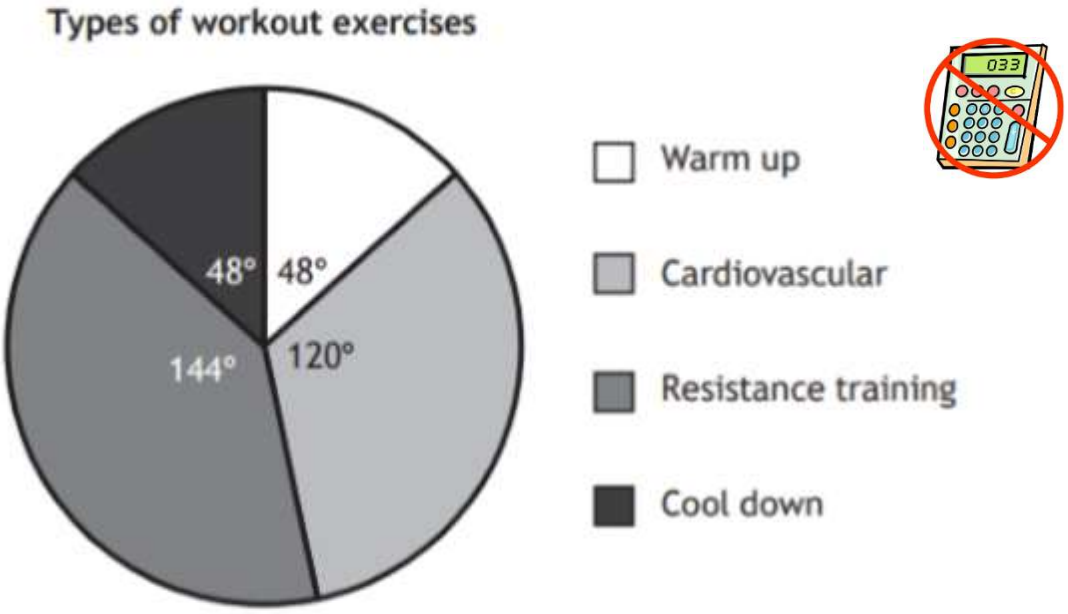
So 9 or less hours = 72 − 6 − 18 = 48

48 people worked 9 or less hours overtime

Probability = $\frac{48}{72} = \frac{4}{6} = \frac{2}{3}$

2. Nicola has joined a gym.

The pie chart shows the proportion of time that Nicola will spend on each type of workout exercise.

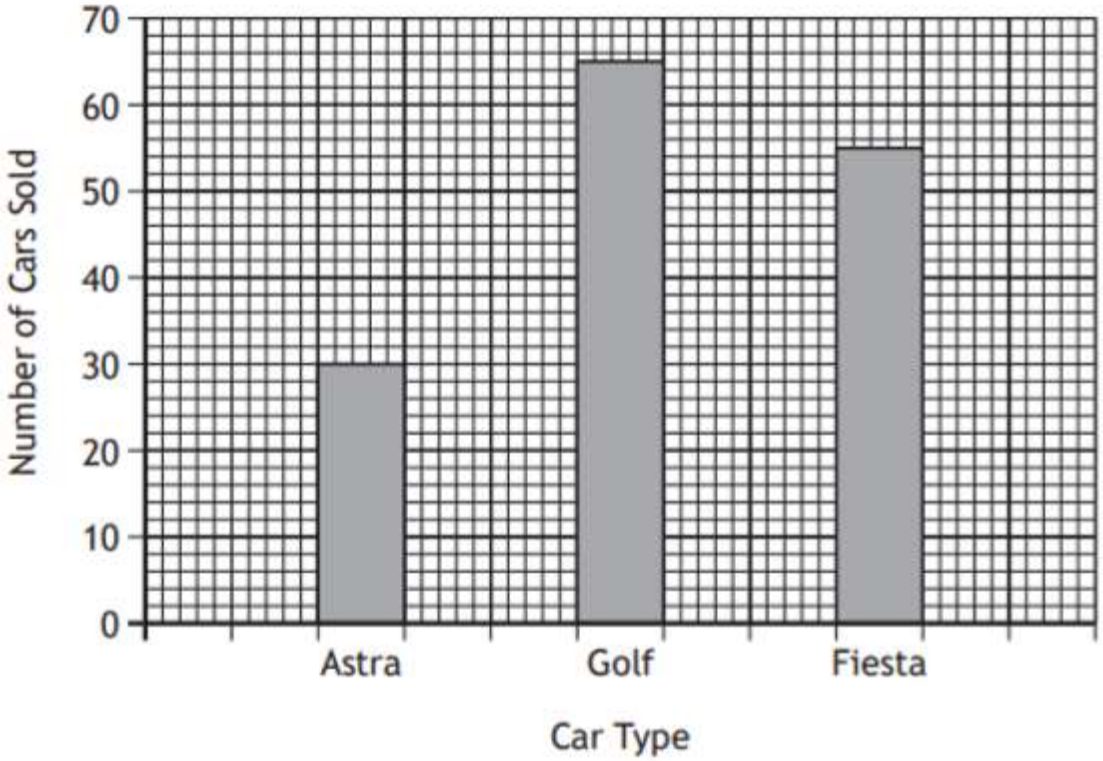


Nicola spent 1 hour and 45 minutes exercising in the gym.

(a) Calculate how long, **in minutes**, Nicola spent on resistance training.

2. A garage sells 150 cars in a month.

The bar chart below shows how many cars of each type are sold.



Construct a pie chart to show this information.

Answers: **1) 42 mins** **2)** •[1] $\frac{30}{150}, \frac{65}{150}, \frac{55}{150}$ or equivalent

•[2] 72°, 156°, 132°

•[3] Pie chart completed with labels

STEM AND LEAF DIAGRAM EXAMPLE

The back to back stem and leaf diagram shows data gathered at a gymnasium before and after walking on a treadmill.

Heart rate data (beats per minute (bpm))

Before						After					
		9	8	3	2	0	5	9			
6	6	6	1	1	0	0	6	2	4	7	8	8
				9	6	2	7	1	1	1	8	
							8	2	4	9		
							9	2	5			

7|8 = 78

median before = 61

median after = 71

n = 15 n = 15

(a) State the most common heart rate (bpm) **after** walking on the treadmill. 71 bpm

(b) What is the difference in the median heart rates (bpm) before and after walking on the treadmill? 71 − 61 = 10 bpm

(c) Construct a boxplot to show the heart rate data after exercise.

1.

This back-to-back stem and leaf diagram represents the number of hours a class spends on social networking websites in a week.

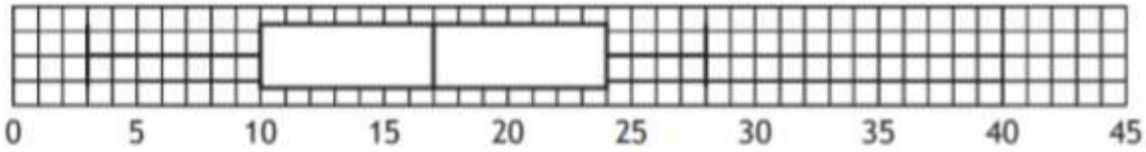
Girls		Boys
	0	3 6 8 9
8 4 3 0	1	1 2 4 7 7 8 9
9 8 7 6 2 2 1	2	2 6 7 8 8
7 2 0	3	
2	4	
n = 15		n = 16

KEY

3 | 1 | represents 13 hours

2 | 5 | represents 25 hours

(a) A boxplot is drawn to represent one set of data.



Which set of data does this represent?

Give a reason for your answer.

(b) For the other set of data, state:

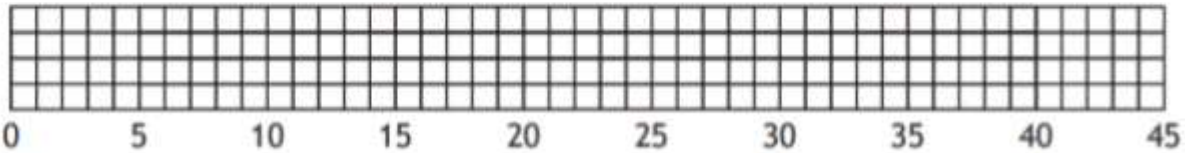
the median

the lower quartile

the upper quartile.

(c) Construct a box plot for the second set of data.

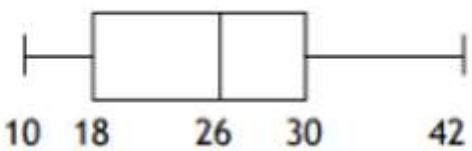
2.



Answer:

(a) Ans: boys with valid reason **(b) Ans: 26, 18, 30**

(c) Ans:



•[1] end points at 10 and 42

•[2] box showing Q_1, Q_2, Q_3

SCATTERGRAPHS

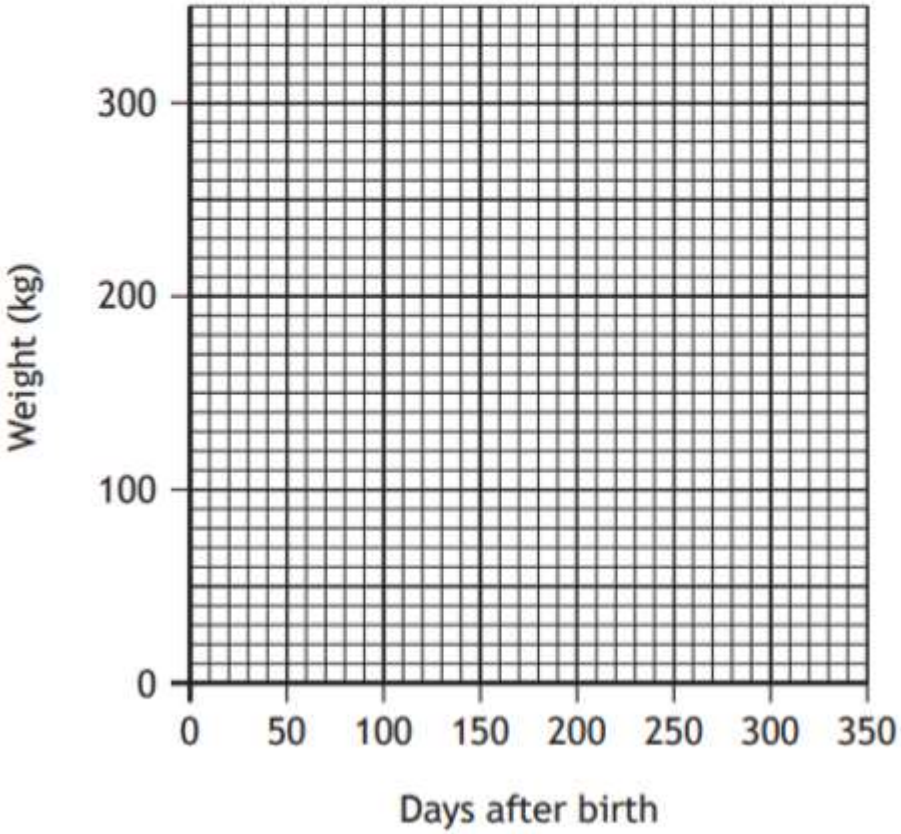
1. Scott is a farmer.

He records the weight of a calf from birth.

The weight of his calf is shown in the table below.

Days after birth	0	60	120	160	200	260
Weight (kg)	40	110	130	175	220	275

(a) On the grid below draw a scatter graph to show this data.



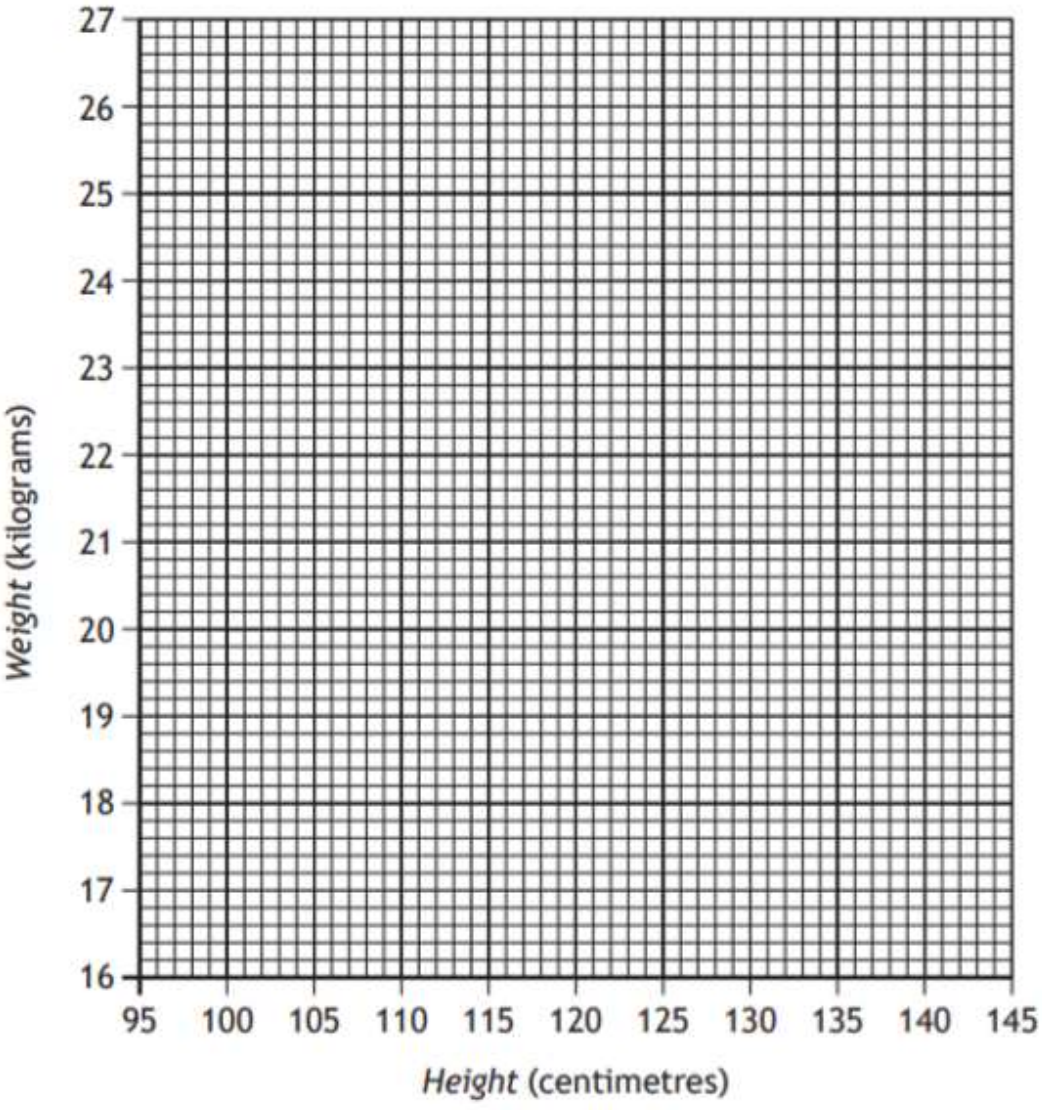
(b) Draw a line of best fit on the diagram above.

(c) Use your line of best fit to estimate the **age** of this calf in days when weighed 240 kilograms.

3. The heights and weights of 8 children aged six are recorded in the table below.

Height in centimetres	104	107	120	124	99	127	104	130
Weight in kilograms	18	19	24	22	17	25	19	24

(a) On the grid below draw a scattergraph to show this data.



(b) Draw a line of best fit on the scattergraph.

(c) Use your line of best fit to estimate the height of a child who weighs 20 kilograms.

SKILL 9: Foreign Exchange

Example (non calculator):

Jack is going to a festival in the Czech Republic from his home in Glasgow.

His mum orders the tickets costing 1500 Czech Koruna.

His mum lives in Poland so he must pay her back in Polish Zloty.

Rates of exchange	
Pounds Sterling (£)	**Other Currencies**
1	30·00 Czech Koruna
1	4·96 Polish Zloty

Calculate how many Polish Zloty he must give to his mum.

Step ① change 1500 CK to £

= 1500 ÷ 30 = £50

step ② change £50 to Polish Zloty

= 50 × 4·96

= 49·6 × 5 = 248 PZ

49·6
× 5
248·0

1. Gavin is going to South America to do charity work.

He changes £750 into Bolivian boliviano.

Currency exchange	
Pounds sterling (£)	**Other currencies**
1	20 Argentine peso
1	9 Bolivian boliviano
1	4 Brazilian real

(a) How many Bolivian boliviano will he receive?

He spends 2700 Bolivian boliviano.

He changes the remaining Bolivian boliviano into Argentine peso.

(b) How many Argentine peso will he receive?

2. Elaine goes on a 5 day long business trip to Oslo in Norway.

She changes £750 to Norwegian kroner for the trip.

Rates of exchange	
Pounds Sterling (£)	**Other Currencies**
1	NOK 8·00 (Norwegian kroner)
1	€1·20 (euros)

(a) How many Norwegian kroner will Elaine receive?

(b) Elaine spends NOK 520 each day she is in Norway.

Her company extends her trip by sending her to Munich in Germany for a further 3 days.

If she changes all her remaining kroner to euros, how many euros will she receive?

She spends €135 each day she is in Munich.

How much money does she have left at the end of her trip?

Give your answer in pounds sterling.

3. Mr and Mrs Sibbald took £2400 spending money.

They exchanged 55% of their money into euro, to spend ashore.

The exchange rate was **£1 = 1·15 euro.**

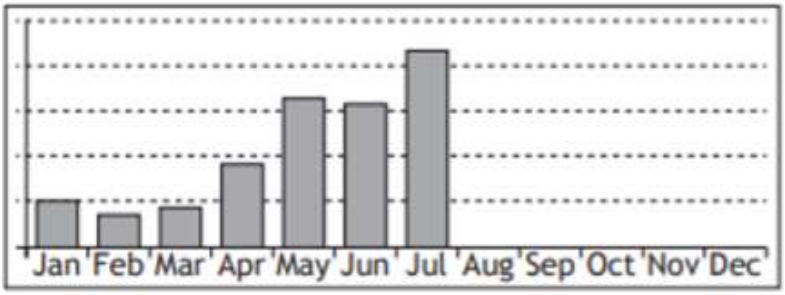
By the end of the cruise they had spent 1379 euro.

(c) Calculate how many euro they had left at the end of the cruise.

4. The table below shows the average monthly exchange rates for British pounds (GBP) to euros (EUR) between January and July 2012.

Foreign Exchange Conversion Data

1 GBP to Euros



Average Monthly Rates

January	1·2018 EUR
February	1·1949 EUR
March	1·1984 EUR
April	1·2166 EUR
May	1·2435 EUR
June	1·2410 EUR
July	1·2637 EUR

Using the information above, how many more euros would I have received if I changed £500 when the exchange rate was at its highest in comparison to its lowest?

Show all your working.

Answers

1. a) 6750 boliviano b) 9000 peso
2. a) 6000 kroner b) £87.50
3. 139 euros
4. 34.40 euros

SKILL 10: Speed, Distance and Time or Time problems

Example:

A plane leaves London at 0820 and flies from London to Rio de Janeiro. The time in Rio de Janeiro is 3 hours behind GMT.

The distance flown by the plan is 5912.5 miles and the average speed of the plane is 550 miles per hour.

What is the local time in Rio de Janeiro when the plane lands?

Time taken: $T = \frac{D}{S} = \frac{5912.5}{550} = 10.75$

$= 10$ hrs 45mins

0820 + 10 hrs 45min − 3 hrs

= 0820 + 7hrs 45mins

= 1605

1. Usain flies from London to Moscow for a business meeting.

The plane leaves London at 1845.

The flight takes 3 hours and 40 minutes.

Moscow time is 4 hours ahead of London.

It should take 45 minutes to collect his luggage and clear security.

His company arranges for a driver to collect him from Moscow Airport.

At what time should the driver expect to collect Usain?

2. Chris flew from Perth, Australia, to London, United Kingdom, on Saturday 9th January 2016.

- The plane left Perth, Australia, at 13:05.
- The total journey time, including a stopover in Dubai, is 20 hours and 25 minutes.
- Perth time is 8 hours ahead of London.

At what time did the plane land in London?

3. Mr Mackenzie accepts the job in Durban.

As part of his job he is in contact with the London, New York and Mumbai offices of the company he works for.

He is planning a conference call at 3:30 pm the following day, from his office in Durban.

At 17:25 he noticed the clocks on the wall of his office showed the times below.

10:25	15:25	17:25	22:55
New York	London	Durban	Mumbai

All offices work 08:00 to 18:00 local time.

(c) Which offices are available to take part in the conference call?

4. Steven flew to Hong Kong to start a new job.

The flight included a stop in Doha.

He flew from Edinburgh to Doha then from Doha to Hong Kong.

- The flight from Edinburgh to Doha took 6 hours 35 minutes.
- The flight from Doha to Hong Kong took 7 hours 20 minutes.
- Hong Kong is 8 hours ahead of Edinburgh.

Steven's plane took off from Edinburgh at 9:15 am local time.

It landed in Hong Kong at 8:50 am local time.

How long was the stop in Doha?

5. Alzena drove from Glasgow to Manchester Airport, 252 miles away.

Alzena left Glasgow at 11.25 pm.

She arrived at Manchester Airport at 3.25 am.

(a) How long did Alzena's journey take ?

(b) Calculate her average speed in miles per hour for the journey.

Answers:

1) 0310 or 3.10am

2) 01:30 on Sunday 10th January 2016

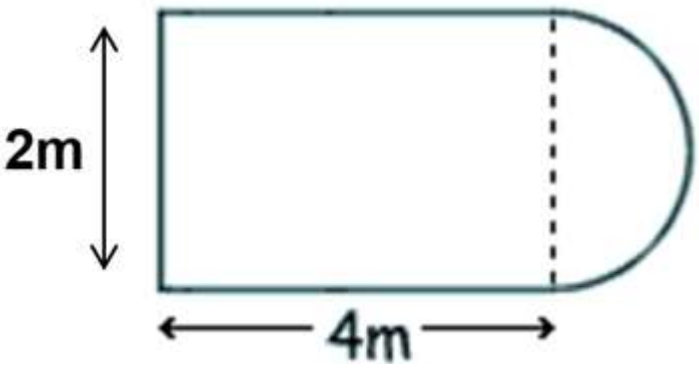
3) NY (8.30am) and London (1.25pm)

4)1 hour 40 mins

5) a) 4 hours b) 63mph

Skill 11: Area/Perimeter

Example: Calculate the area and the perimeter of this pond.



Perimeter

For circle use $C = \pi \times D = \pi \times 2 = 6.28m \div 2 = 3.14m$

For rectangle part $2 + 4 + 4 = 10m$

total perimeter = $13.14m$

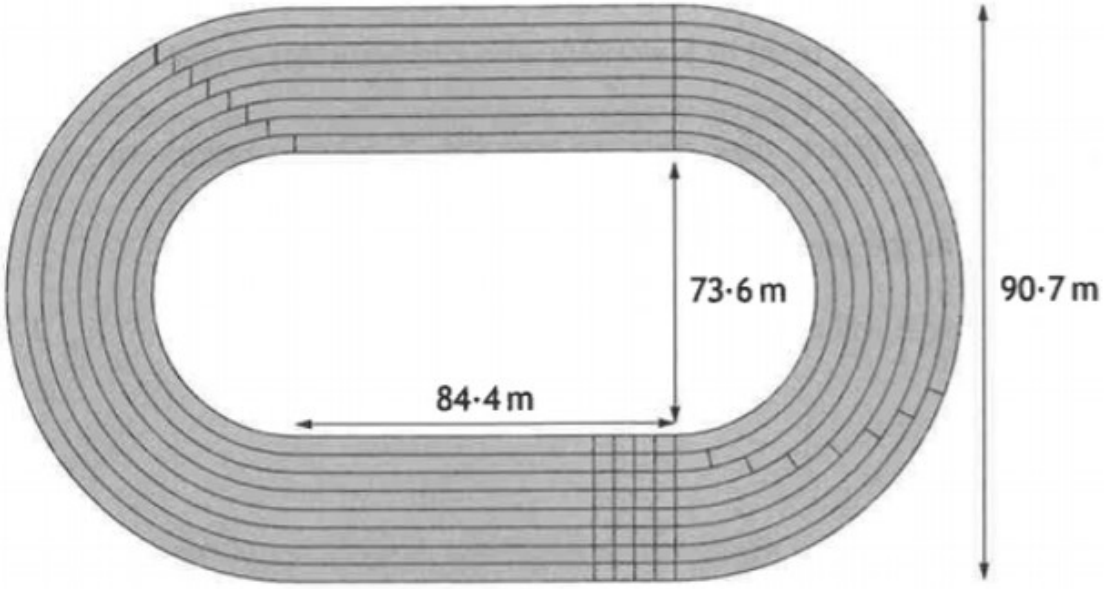
Area

Circle $A = \pi \times r^2 = \pi \times 1^2 = 3.14 \div 2 = 1.57m^2$

rectangle $= 4 \times 2 = 8m^2$

total area $= 1.57 + 8 = 9.57m^2$

1. A sports ground is in the shape of a rectangle and two semi-circles as shown.



The running track is shaded in the diagram.

(a) Calculate the area of the running track.

2. A new hotel is being planned in Benidorm.

The pool will have a walkway around three sides.

The walkway will be 1·5 m wide.

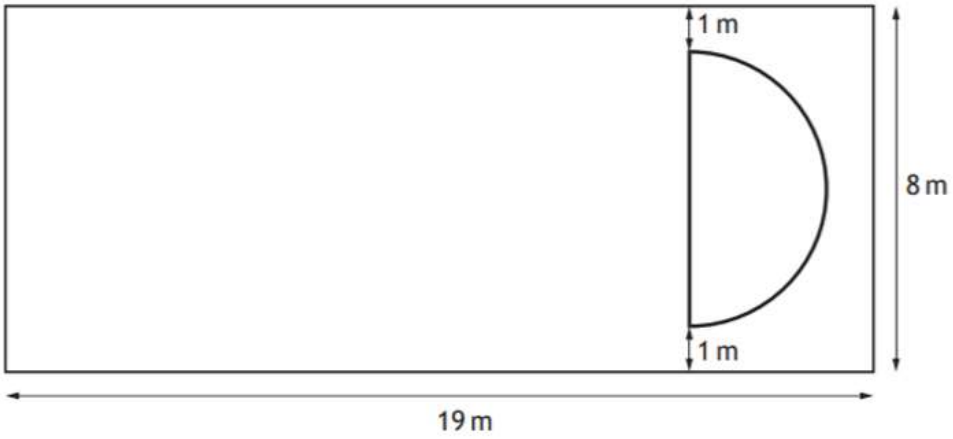
This is shown in the diagram.

Calculate the total area of the walkway.

3. A new playground is planned for Aberbeath Primary School.

It will be a rectangle measuring 19 metres by 8 metres.

A semi-circular sandpit will be built within the playground as shown



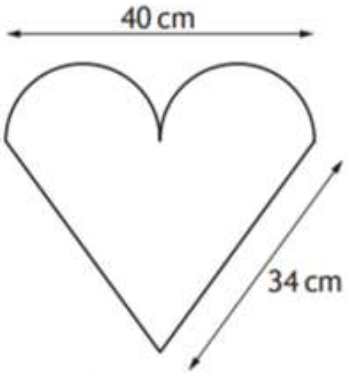
The playground, excluding the sandpit, is to be covered in rubber tiles.

Calculate the area to be covered by the rubber tiles.

Take $\pi = 3{\cdot}14$.

Give your answer to **3 significant figures**.

4. Ribbon has to be placed around the outside of the love heart cake shown below.



The top of the cake is in the shape of an isosceles triangle with two identical semi-circles.

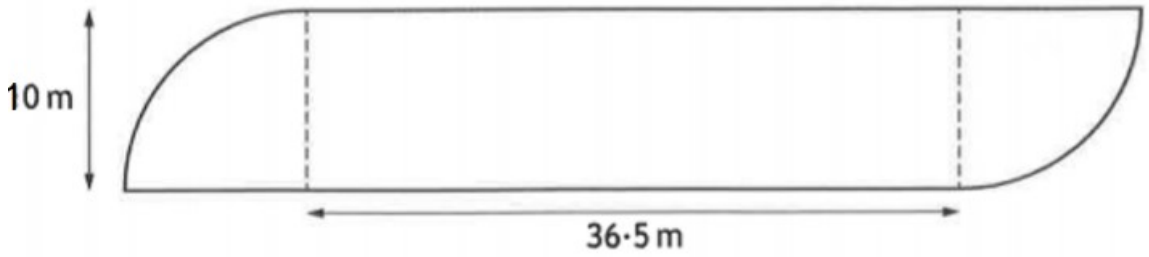
The ribbon needs to be the length of the perimeter of the top of the cake plus an extra 2·8 cm.

Calculate the length of ribbon needed for the cake.

Take $\pi = 3{\cdot}14$.

5. A hotel is having a swimming pool built.

It is in the shape of a rectangle and two quarter circles as shown below.



The swimming pool will have a safety rail fitted around its edge.

- There will be two 125 cm wide gaps to allow access to the pool
- Safety rail is sold in 3 metre lengths
- Each 3 metre length costs £11·49

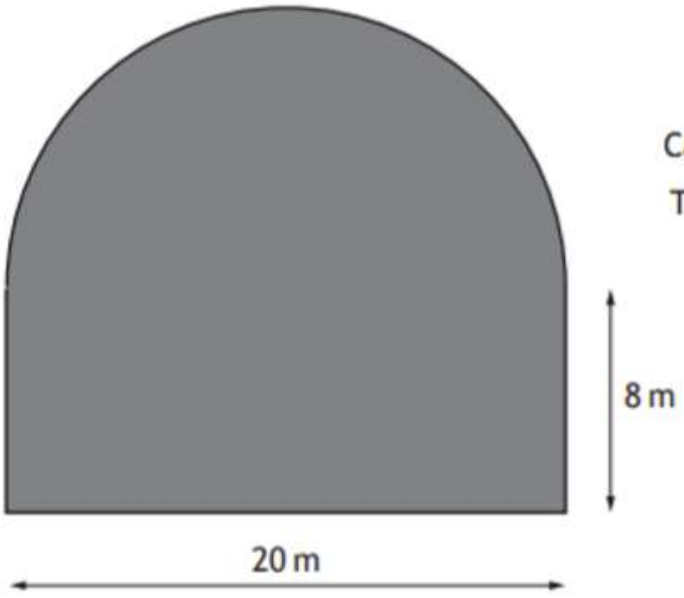
Calculate the minimum cost of the safety rail for the pool.

6. Joe buys a plot of land in the shape of a rectangle and a semi-circle, as shown below.

He plans to put a fence around the plot of land.

He employs Fence Direct to build the fence.

Fence Direct charges £15 per metre including all materials and labour.



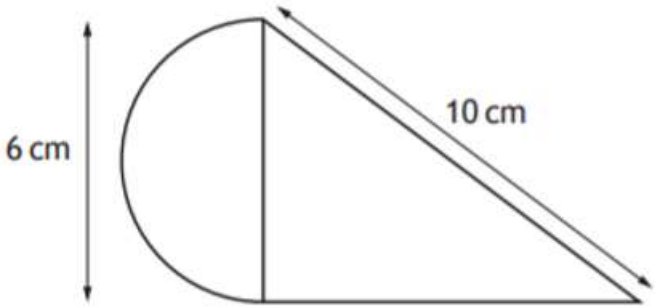
Calculate the cost of the fence.

Take $\pi = 3{\cdot}14$.

7. A new design is discussed for a glue dispenser.

It is to be made from two plates of plastic.

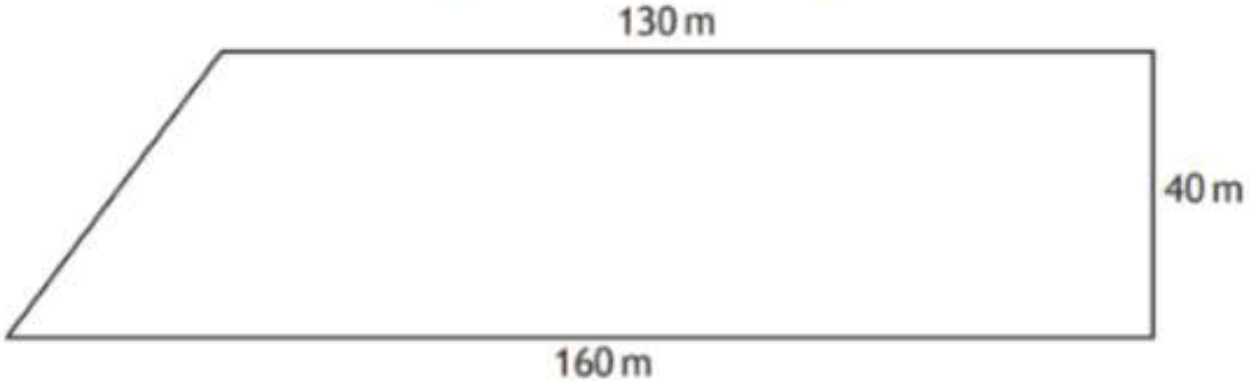
Each plate is in the shape of a right angled triangle and a semi-circle as shown.



(a) Calculate the perimeter of each plate.

Use $\pi = 3{\cdot}14$.

8. A farmer needs to **completely enclose** this field with a new fence.



The fence is only sold in 80 metre rolls. Each roll costs £73·99.

Calculate the cost of the new fence.

(Do Pythagoras first – Look back at Skill 4)

Answers

1. 3649.839m^2 2. 64.5m^2 3. 138m^2 4. 133.6cm

5. £471.09 6. £1011 7. 27.42cm 8. £369.95

Skill 12: Probability

Example:

Debbie counts the videos and DVDs she has and places them into categories.

	Video	DVD
Film	23	10
Comedy	12	5

She randomly picks one out. Calculate the probability that it is

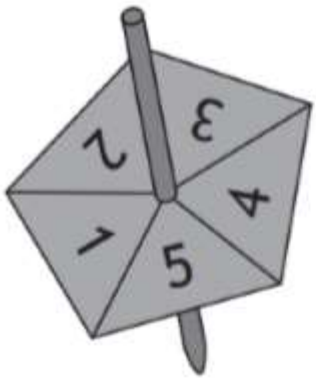
a) a comedy

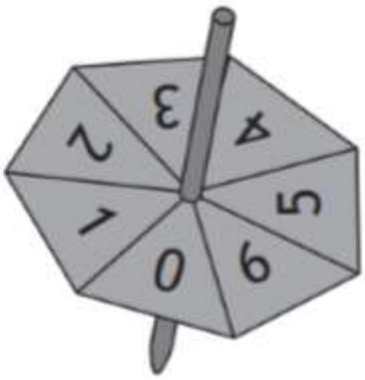
(a) $\frac{17}{50}$ ← number of comedies
← total

b) a film on DVD

(b) $\frac{10}{50} = \frac{1}{5}$

1. Michael runs a stall at the school fayre.
His game requires two spinners to be spun and allowed to come to rest.
The spinners are shown below.





The numbers on which the spinners come to rest are multiplied together.
To win a prize the answer to this multiplication must be **less than 5**.
Calculate the probability of winning a prize.

2. Mr and Mrs Sibbald take part in an on board lottery which consists of a draw from a set of 32 balls numbered from 1 to 32.

(d) (i) What is the probability that the first ball drawn has a number greater than 25?

In the draw four numbered balls are drawn and not replaced.

A further bonus ball is also drawn.

(ii) What is the probability of the number 9 being drawn as the bonus ball if it was not drawn in the first four?

3. S6 pupils were asked to choose their favourite subject.

The results are shown in the table below.

Subject	Boys	Girls
Geography	11	7
French	9	14
Maths	18	13
Spanish	10	12
Modern Studies	18	8
Total	66	54

Calculate the probability that a boy from this group chose French as his favourite subject.

Give your answer as a fraction in its simplest form.

4. Aneesha and Brian are playing a board game. Each move is determined by rolling two dice.

Aneesha requires a total of **10 or more** on her next roll to win the game.

What is the probability of Aneesha winning the game on the next roll?

Give your answer as a fraction.

5. Mrs Abid took a survey in her mathematics class of how pupils travelled to school.

The results are shown in the table.

	Walk	Cycle	Bus
Boys	6	4	3
Girls	2	3	12

What is the probability that a pupil chosen at random is a girl who cycles to school?

Give your answer in its simplest form.

Answers:

1) $\frac{13}{35}$ 2) (i) $\frac{7}{32}$ (ii) $\frac{1}{28}$ 3) $\frac{3}{22}$ 4) $\frac{1}{6}$ 5) $\frac{1}{10}$