National 5 Applications of Maths

Exam Revision Pack

Last updated May 2024

How to use this booklet

Most questions are in 'pairs'. If you get the first question in a pair correct with no help needed, then you can choose to not do the second question in the pair.

A rough number of marks for each question is given in brackets after each question. e.g. **(2)**

For each question, the symbols 🖩 or 🚫🖩 are used to show whether a calculator is allowed.

Questions marked A are harder questions for those aiming for an 'A' grade.

1. Try all of the questions and check the answers. Ask for help as required. If your target is a 'C' or 'B' grade, you may choose to miss out questions marked **A** .
2. Put a star next to all the questions you got wrong **or required help** with (the help may have been from teachers, friends or notes).
3. Wait a few days and then try the starred questions again: can manage them now?
4. If you cannot do them, ask for help again, wait a day or two and then try them again.
5. **Repeat until you can do all the questions without needing help.**

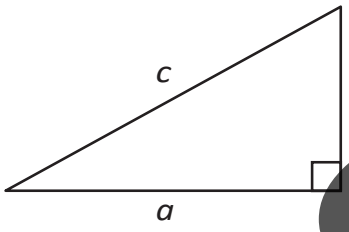
Contents

FORMULAE LIST

Circumference of a circle: $C = \pi d$

Area of a circle: $A = \pi r^2$

Theorem of Pythagoras:



$a^2 + b^2 = c^2$

Volume of a cylinder: $V = \pi r^2 h$

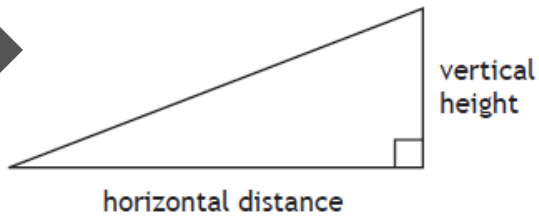
Volume of a prism: $V = Ah$

Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

Volume of a sphere: $V = \frac{4}{3}\pi r^3$

Standard deviation: $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n-1}}$,
where n is the sample size.

Gradient:



$$\text{Gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

A) Ratio

1) The ratio of technicians to scientists in a laboratory is 5 : 7. There are 112 scientists. Calculate the number of technicians working at the factory. **(2)**

2) A particular shade of purple paint is made by mixing red and blue paint in the ratio 9 : 4. 2970 litres of red paint is used. Calculate the amount of blue paint that must be used. **(2)**

3) Rabbit food is made by mixing oats and barley in the ratio 5 : 3. Hettie makes rabbit food using 900 grams of barley. Calculate the **total** amount of rabbit food that Hettie made. **(2)**

4) Jacinta runs a company. Her budget is split between wages and equipment in the ratio 10 : 7. The budget for wages Is £39 000. Calculate the **total** budget for the company. **(2)**

5) The ratio of flour, sugar and butter in a cake recipe is 4 : 3 : 2. Graeme uses 240 grams of butter in the recipe. Calculate the amount of sugar Graeme must use. **(2)**

6) The marks in a French exam are for reading, speaking and listening in the ratio 5 : 6 : 7. There are 30 marks for speaking. Calculate how many marks are for listening. **(2)**

7) A drink is made using lemon juice, orange juice and lemonade in the ratio 6 : 7 : 2. The **total** amount of lemonade made is 3 litres. Calculate the amount of orange juice used. Give your answer in millilitres. **(2)**

8) The distances for swimming, cycling and running in an Olympic triathlon are in the ratio 3 : 80 : 20. The **total** distance is 51 500 metres. Calculate the distance of the swimming section. Give your answer in kilometres **(2)**

9) The mathematics teachers in a school win a lottery. They decide to share their winnings in proportion to the amount they each pay per week. They each pay the following amounts per week:

- Mr Davidson: £0·50
- Miss Leighton: £3·00
- Mrs Gibb: £1·50
- Mr Leach: £4·00

Mr Leach's share is £5 103 000. Calculator how much the teachers win in **total**. **(3)**

10) The budget given to each department of a school is proportional to the number of hours that students spend in that department:

- Science 4 hours per week
- Maths 5 hours per week
- Languages 7 hours per week
- Technologies 8 hours per week
- Arts and PE 11 hours per week

The Languages department has a budget of £3843. Calculate the **total** budget given to the five departments. **(3)**

D) Comparing Fractions and Percentages

29) $\frac{90}{300}$ of the pupils in a school are in S2. 35% of the pupils are in S3. Determine which year group has more pupils. Justify your answer.

30) John scored $\frac{52}{80}$ in his Advanced Higher German exam. Phil scored 58% in the same exam. Determine who got the higher score. Justify your answer.

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31) Green Hill has a gradient of $\frac{1}{6}$. Red Hill has a gradient of $\frac{2}{11}$. Determine which hill is steeper. Justify your answer. **(3)**

32) The probability of Jack passing an exam is $\frac{7}{8}$. The probability of Helena passing the same exam is $\frac{13}{15}$. Determine who has the greater probability of passing the exam. Justify your answer. **(3)**

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33) The gradient of a wheelchair ramp is $\frac{1}{40}$. The manufacturer says that their wheelchair ramps have a gradient lower than 3%. Determine whether the manufacturer is correct. Justify your answer. **(2)**

34) $\frac{5}{7}$ of Katy's class passed their Higher Latin exam. Across Scotland, 60% of people passed. Determine whether Katy's class had a better pass rate than the Scottish pass rate. Justify your answer. **(2)**

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35) Farm A has 56 cattle. 35 of them are female.
Farm B has 24 cows. 16 of them are female.
Determine which farm has a greater proportion of female cattle. Justify your answer. **(3)**

36) Farm A has 45 sheep. 18 of them are male.
Farm B has 32 sheep. 12 of them are male.
Determine which farm has a greater proportion of male sheep. Justify your answer. **(3)**

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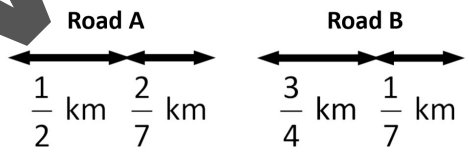
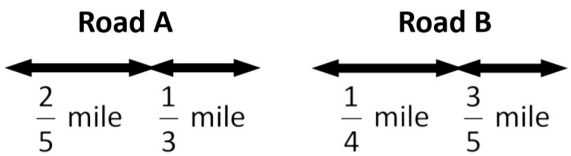
37) **A** The diagram shows two roads. Determine which road has the longer total length. Justify your answer. **(4)**



38) **A** The diagram shows two roads. Determine which road has the longer total length. Justify your answer. **(4)**



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111) Daniel jogs at an average speed of 2·98 m/s from 9:40pm until 10:10pm. Calculate the total distance that Daniel jogged. Give your answer in kilometres. **(4)**

112) A plane flies 2130 km at a speed of 300 km/h. Calculate the time taken for the journey. Give your answer in hours and minutes. **(4)**

113) Susan is driving from Dalkeith to York. The computer in her car tells her that she has done 210 miles at an average speed of 50 mph. Susan left Dalkeith at 17 55. Calculate the time at which she arrives in York. **(4)**

114) Daniel does a run every evening. He starts running at 9:40pm and runs without stopping. When he finishes, an app on his phone tells him that he ran at an average speed of 10 m/s for 4 kilometres. Calculate the time he finished his run. **(3)**

N) Time Zones and Intervals

115) Karen flew from Manchester to Doha.
- Her flight landed in Doha at 20:10 local time.
- The flying time was 7 hours 25 minutes.
- Doha is two hours ahead of Manchester time.

Calculate the local time that the flight left Manchester. **(2)**

116) Seán flew from Glasgow to New York.
- His flight landed in New York at 07:55 local time.
- The flying time was 6 hours 40 minutes.
- New York is five hours behind Glasgow time.

Calculate the local time that the flight left Glasgow. **(2)**

117) Steven flew from Edinburgh to Tokyo. The flight included a stop in Cairo. He flew from Edinburgh to Cairo then from Cairo to Tokyo.
- The flight from Edinburgh to Cairo took 4 hours 50 minutes.
- The flight from Cairo to Tokyo took 8 hours 15 minutes.
- Tokyo is 9 hours ahead of Edinburgh.

Steven's plane took off from Edinburgh at 1:40 pm local time. It landed in Tokyo at 1:30 pm local time the next day. Calculate the length of the stop in Cairo. **(3)**

118) Ana-Lucia flew to Sydney. The flight included a stop in Caracas. She flew from Glasgow to Caracas then from Caracas to Sydney.
- The flight from Glasgow to Caracas took 7 hours 10 minutes.
- The stop in Caracas lasted 3 hours 55 minutes.
- The flight from Caracas to Sydney took 8 hours 35 minutes.
- Sydney is 11 hours ahead of Glasgow.

Ana-Lucia's plane took off from Glasgow at 6:35 am local time. Calculate the local time when she landed in Sydney. **(3)**

119) *(2018 SQA exam question)* It takes 277 hours to sail from the UK to Canada.
The local time in Canada is 5 hours behind the local time in the UK.
The ship leaves the UK at 2200 on 3 June.
Calculate the date and local time that the ship will arrive in Canada. **(3)**

O) Tolerance

125) 4 pieces of wood are used to make a gate. Each piece of wood is cut to a length of 260 cm ± 5 cm. What is the minimum **total** length of the 4 pieces of wood? **(2)**

126) A box contains 6 eggs. Each egg has a weight of 45 grams ± 3 grams. What is the maximum **total** weight of the 6 eggs? **(2)**

127) *(2018 exam question)* A baking company rejects cakes if they do not weigh 400 g ± 3%. The weights (in grams) of a sample of 13 cakes are shown below.

385, 391, 409, 403, 386, 412, 413, 407, 400, 390, 387, 405, 388

Calculate the fraction of cakes that will be rejected. **Use your working to justify your answer**. **(3)**

128) Packets of cereal go through a quality control process. Packets are rejected if they are not in the range 500 g ± 2%.
The weight (in grams) of eleven packets was counted and recorded as follows:

490 503 512 498 500 506 487 494 501 491 499

Calculate the fraction of packets that will be rejected. **Use your working to justify your answer**. **(3)**

129) Vicky is a plumber. For her next job she requires bolts that measure 8 cm ± 0·2 cm. She has 20 bolts, with lengths (in centimetres) as shown below.

8·13	6·9	7·2	8·08	8·0	7·91	7·84	7·8	8·41	8·11
8·3	7·84	7·9	7·69	8·01	7·75	7·99	8·02	8·9	8·14

Calculate the percentage of bolts that Vicky could use. **(3)**

130) Mark is a nurse and he is sending blood samples to the lab. He can only send blood samples that contain 18 ml ± 0·7 ml of blood. He has taken 25 blood samples, with volumes (in millilitres) shown below.

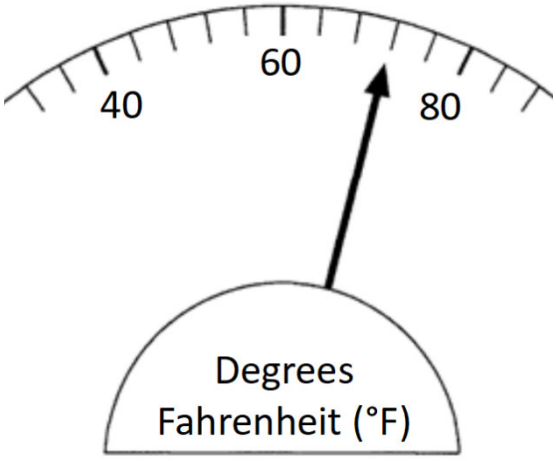
17·8	17·89	20·0	17·38	17·45	18·09	18·27	18·49	16·95
17·99	18·3	17·65	18·42	18·25	17·5	18·6	17·2	18·64
18·98	17·15	18·0	18·81	17·7	18·13	18·5		

Calculate the percentage of blood samples that Mark cannot send. **(3)**

131) Olivia is an artist who works with clay.

Acceptable temperatures for her studio are in the range 70°F ± 3·5°F.

The current temperature in the studio is shown on the temperature dial in the picture on the right. Determine whether the studio is at an acceptable temperature. **Justify your answer**. **(3)**



152) Lianna is a social worker. Her annual gross salary is £31 270.

National Insurance is calculated on a person's salary before deductions such as pension contributions. The rates of National Insurance are shown in the table.

National Insurance rates	
Up to £8675	0%
From £8675 to £43020	14%
Over £43020	4%

a) Calculate Lianna's National Insurance payment. **(2)**

Lianna pays 11% of her annual gross salary into her pension.
Lianna's **annual** income tax payment is £4585·12.
She is paid in 52 equal **weekly** payments.

b) Calculate Lianna's weekly net pay. **(2)**

153) **A** Thandiwe is a doctor. Her annual gros salary is £64 200.

National Insurance is calculated on a person's salary before deductions such as pension contributions. The rates of National Insurance are shown in the table.

National Insurance rates	
Up to £10300	0%
From £10300 to £42760	11%
Over £42760	2%

a) Calculate Thandiwe's National Insurance payment. **(3)**

Thandiwe pays 7% of her annual gross salary into her pension.
Thandiwe's **annual** income tax payment is £9524·36.
She is paid in 52 equal **weekly** payments.

b) Calculate Thandiwe's weekly net pay. **(2)**

154) **A** Kira is a senior police officer. Her annual gross salary is £52 000.

National Insurance is calculated on a person's salary before deductions such as pension contributions. The rates of National Insurance are shown in the table.

National Insurance rates	
Up to £8924	0%
From £8924 to £47200	14%
Over £47200	3%

a) Calculate Kira's National Insurance payment. **(3)**

Kira pays 8% of her annual gross salary into her pension.
Kira's **annual** income tax payment is £8306·56.
She is paid in 12 equal **monthly** payments.

b) Calculate Kira's monthly net pay. **(2)**

S) Loans and Hire Purchase

155) Adam is buying a new television.
Its advertised price is £950. Adam decides to use a payment plan to buy the TV.
The **total** cost of the TV using the payment plan is £1020.
The payments are calculated as follows:

- Deposit of $\frac{1}{5}$ of **advertised price**.
- 10 equal monthly instalments
- Final payment of £90.

Calculate the monthly instalment. **(3)**

156) Maddie is buying a new three-piece suite.
Its advertised price is £1400. Maddie decides to use a payment plan to buy it.
The **total** cost of the suite using the payment plan is £1620.
The payments are calculated as follows:

- Deposit of $\frac{1}{4}$ of **advertised price**.
- 7 equal monthly instalments of £125
- Final payment.

Calculate the final payment. **(3)**

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157) Julia is buying a new car.
Its advertised price is £19 500. Julia buys it using a payment plan.
The payments are calculated as follows:

- Deposit of 22% of **advertised price**.
- 17 equal monthly instalments of £980·45.
- Final payment of £980·35.

Calculate the total price of the payment plan. **(2)**

158) Chetna is buying a new car.
Its advertised price is £26 350. Chetna buys it using a payment plan.
The payments are calculated as follows:

- Deposit of 18% of **advertised price**.
- 23 equal monthly instalments of £870·26.
- Final payment of £891·02.

Calculate the total price of the payment plan. **(2)**

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159) Sinéad takes out a loan of £11 200.
The interest plus the administration fee is 12% of the loan amount.
The total amount will be paid back in 20 equal monthly payments.
Calculate Sinéad's monthly payment. **(3)**

160) *(2019 SQA exam question)* 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 Allana's monthly payment. **(3)**

215) A group of 120 children from a Primary School were asked to name their favourite flavour of ice cream. The results are shown in the table on the right.

Construct a pie chart to display this information. Show all of your working. **(3)**

Flavour	*Number of pupils*
Strawberry	22
Raspberry	17
Chocolate Chip	46
Vanilla	35

216) A group of 480 people were asked to name their favourite TV reality competition. The results are shown in the table on the right.

Construct a pie chart to display this information. Show all of your working. **(3)**

Soap	*Number of people*
Bake Off	268
Strictly	64
Drag Race	92
Other	56

217) Police are checking whether cars are safe to drive. They stop any cars where they see a fault. They stop 40 cars in total. The reasons for stopping cars are shown in the table on the right. Construct a pie chart to display this information. Show all of your working. **(3)**

Fault	*Number of cars*
Exhaust faulty	6
Broken lights	19
Tyres worn	13
Other	2

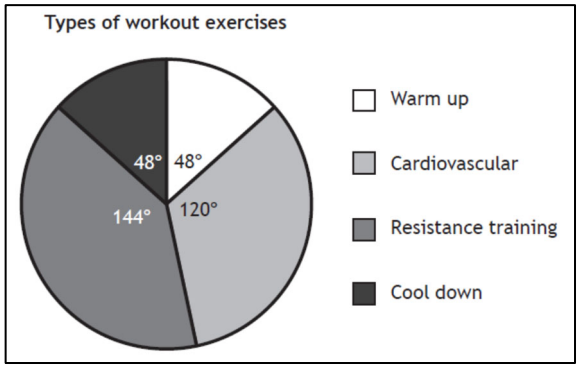
218) A school has 60 teachers. The table on the right shows their place of birth.

Construct a pie chart to display this information. Show all of your working. **(3)**

Place	*Number of teachers*
Scotland	19
Rest of UK	14
North America	9
Asia	18

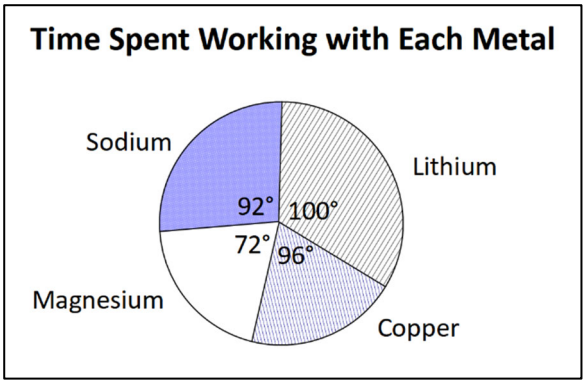
219) *(2018 SQA exam question, adapted)* Fiona has joined a gym. The pie chart on the right shows the proportion of time that Fiona will spend on each type of workout exercise.

Fiona spent 1 hour 15 minutes exercising in the gym. Calculate how long, in minutes, Fiona spent on her warm up. **(3)**



220) Cathy is a science research assistant. She is doing an experiment involving metals. The pie chart shows the proportion of time Cathy spends working with each type of metal during the experiment.

Cathy spends 1 hour 30 minutes on the experiment in total. Calculate how long, in minutes, Cathy spent working with magnesium. **(3)**



GG) General Non-Calculator (no context)

Further worksheets of practice noncalculator questions can be downloaded at:
https://www.dynamicmaths.co.uk/Sheets/WholeCourse/dynamic-nat5applicationsnoncalc.xlsm

271) £20·40 × 8 + £25·80 × 6 + £24·90 × 8

272) £32·10 × 4 + £55·70 × 8 + £45·20 × 7

273) £8·40 × 30 – £13·24 – £11·76

274) $5·60 × 40 – £25·55 – £13·45

275) $1-\frac{1}{3}-\frac{2}{5}$

276) $1-\frac{1}{4}-\frac{2}{3}$

277) Round 5·3956692 to 3 decimal places

278) Round 145·28472 to 2 decimal places

279) Round $5082·248 to 2 significant figures

280) Round $67 294·9577 to 3 significant figures

281) 60% of 91·8 metres

282) 30% of 7256 kg

283) 7·5% of 66 000km

284) 12·5% of 1560 litres

285) $\frac{2}{5}$ of £9400

286) $\frac{2}{3}$ of 756 Euros

287) What time is 3 hours 50 minutes earlier than 20:05 ?

288) What time is 4 hours 25 minutes later than 0545 ?

289) $3·14 × 4^2 \div 2$

290) $3·14 × 8^2 \div 2$

291) Express $\frac{600}{7200}$ as a fraction in its simplest form

292) Express $\frac{162}{3000}$ as a fraction in its simplest form

293) 12 × £14·20

294) 14 × £15·70

295) 55% of $25

296) 15% of $55

297) Express the ratio 360 : 540 : 120 in its simplest form

298) Express the ratio 45 : 75 : 60 in its simplest form

299) $\frac{3}{8}+\frac{2}{5}$

300) $\frac{6}{7}-\frac{3}{4}$

301) Calculate the square root of $13^2 – 5^2$

302) Calculate the square root of $30^2 + 40^2$

303) 2·4 + 3 × 1·8 – 1·2

304) 8 – 3 × 1·5 + 2·7

HH) MIXED TOPICS

These questions are not in pairs. Try all of these questions.

321) Bartosz runs a window cleaning business.

a) Every day, Bartosz must pay £123 for materials and £161 in wages.
He cleans windows for 100 customers every day.
He wants to make a profit of £500 per day.
He charges each customer the same amount. Calculate the minimum price that he should charge each customer in order to achieve this profit. **(3)**

b) *(Past Dynamic Maths prelim question)* Bartosz needs to buy the following items:

- 1 ladder
- 5 bottles of soap
- 3 buckets
- 4 sponges

Bartosz has three stores in which he could buy each item:

	Warehouse	**Online**	**Hardware Store**
Price for ladder	£145·00	£98·75	£135·40
Price for one bottle of soap	free	£3·90	£2·00
Price for one bucket	free	£5·99	£4·00
Price for one sponge	free	£0·49	£0·90
Special Offer	None	None	**15% discount on total price**

If Bartosz buys all the equipment from the same store, which of the three options is the cheapest? Justify your answer. **(3)**

322) In a survey, 60 people were asked to name their favourite sport. The results are shown in the table on the right.

Sport	***People***
Rugby	17
Cricket	4
Tennis	25
Other	14

a) Kevin says that more than 40% of the people say that tennis is their favourite sport. Determine whether Kevin is correct. Justify your answer. **(2)**

b) Construct a pie chart to display this information. Show all of your working. **(3)**

c) In a different survey, rugby fans were asked their favourite type of rugby.

- $\frac{1}{4}$ of the people chose Rugby Sevens
- $\frac{4}{7}$ of the people chose Rugby Union
- The rest of the people chose Rugby League.

Calculate the fraction of people who chose Rugby League. **(3)**

323) *(Past Dynamic Maths prelim question)* Mandip is a scientist. She is doing a chemistry experiment involving copper.

a) Mandip can only use pieces of copper that weigh 28.5 ± 1.2 grams. The weights of 11 pieces of copper are shown below.

27.85, 29.6, 30.2, 28.0, 29.1, 26.9, 29.8, 29.25, 27.4, 28.5, 27.15

Calculate the fraction of pieces of copper that Mandip could use for her experiment. **(3)**

b) Mandip is paid £16·74 per hour and gets double time for overtime.

In a particular week, Mandip:
- works 30 hours basic time;
- works 4 hours overtime;
- has total deductions from her pay of £34·82.

For this week, calculate Mandip's net pay. **(3)**

c) Using the data given in part (a), calculate:
(i) the median **(1)**
(ii) the upper quartile and lower quartile **(2)**
(iii) the interquartile range **(1)**

d) Mandip uses lead in the same experiment. The interquartile range of the weight of tin used was 1·5 grams. Make **one** valid comment comparing the weight of copper and the weight of tin used in Mandip's experiment. **(1)**

324) Monika is the manager of a petrol station.

a) Monika's salary is £27 500.

National Insurance is calculated on a person's salary before deductions such as pension contributions. The rates are shown in the table.

National Insurance rates	
Up to £8240	0%
From £8240 to £44000	12%
Over £44000	5%

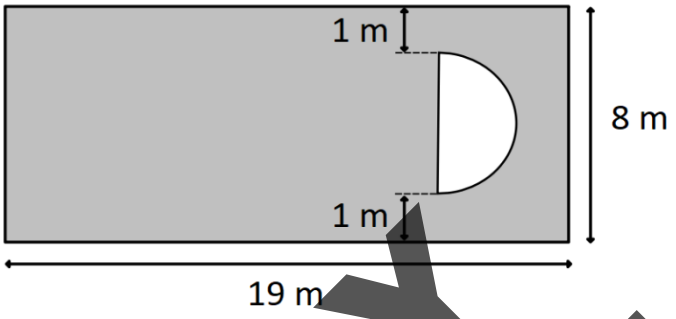
Calculate Monika's **monthly** National Insurance payment. **(2)**

b) **A** One of the customers at the petrol station is fuelling their car.
- The customer's car holds 12 gallons of petrol when full.
- The customer had 1·2 gallons of petrol left in their tank before they started fuelling.
- The customer added petrol until their tank was full.
- Petrol costs £1·54 per litre.

Calculate the total cost of the customer's fuel. **1 gallon = 4·545 litres. (3)**

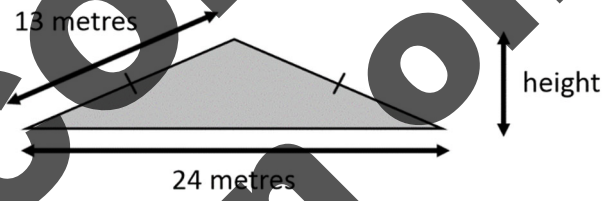
337) *(2016 paper 1)* A new playground is planned for Aberbeath Primary School.

a) The playground will be in the shape of a rectangle measuring 19 metres by 8 metres. A semi-circular sandpit will be built within the playground as shown in the diagram.



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 correct to 3 significant figures. **(4)**

b) **A** In the playground is a climbing ramp in the shape of an isosceles triangle with dimensions as shown in the diagram. Calculate the height of the ramp. **(2)**



338) Anna Burns works as a travelling sales manager for a software company.

a) Anna's March wage slip, shown below, is partly completed.

Name	**Employee Number**	**NI Number**	**Tax Code**	**Month**
Anna Burns	00587370	HR 287594 A	1033L	March

Basic Salary	**Commission**	**Overtime**	**Gross Salary**
£2000·00		£0·00	
National Insurance	**Income Tax**	**Pension**	**Total Deductions**
£158·00	£421·21		
			Net Salary

- Anna is paid a basic monthly salary of £2000.
- She receives commission of 2% of her total monthly sales over £100 000.
- In March, Anna's sales totalled £340 000.
- She pays £158·00 in National Insurance and £421·21 in income tax.
- 6% of Anna's gross monthly salary is paid into her pension fund.

Calculate Anna's net salary for March. **(4)**

b) Anna travels from Birmingham to Inverness.

- The distance she travels is 445 miles.
- The average speed for the journey is 52·1mph.
- Anna left Birmingham at 11:10am and took a 45-minute break during the journey.

Calculate the time that Anna arrived in Inverness. **(4)**