ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education
2009

MATHEMATICS (PILOT)
Units 2 and 3
EXEMPLAR QUESTIONS

These further exemplar questions have been written for the use of teachers in centres involved with the AQA GCSE Mathematics Pilot (9307).

As the pilot develops to reflect the new KS4 Programme of Study for Mathematics, more questions will appear on examination papers that test the functional process skills and are set within realistic contexts. Such questions will, however, be different from the tasks which feature in the separate assessment of Functional Mathematics. GCSE questions will generally be shorter and use simplified but realistic data. Within GCSE, it will also be possible to ask questions on Higher tier papers with a greater technical demand than would be possible in a Functional Mathematics assessment as the full range of GCSE content is available to be tested.

Within this set of questions, there is a bias towards Unit 2. This is because, at this stage of development, questions using content from Number and Statistics lend themselves to a functional approach. It is also the case that use of real data in questions often means that the question can only appear in a calculator allowed paper or section. During the course of the pilot, AQA will seek to develop more appropriate questions that test both functional skills and Unit 3 content. It is expected that, across all units, around 50% of questions on tier F and 20% on tier H will address the functional process skills from 2009 onwards. Further, AQA will seek to achieve a balance of marks across the three process skills of Representing, Analysing and Interpreting.

The questions on the following pages are organised by Unit and tier and each question is followed by a mark scheme and supporting commentary. For each question, the examiner has suggested the grade at which this question will differentiate candidates ie, a question at grade C would be expected to be well done by most candidates expecting to achieve grade B or better, challenging but accessible to most candidates expecting to achieve grade C or D and possibly too difficult for many candidates expecting to achieve grades E to G. Of course, such grades are no more than a rough guide and there is no guarantee that candidates will perform precisely as examiners expect.

AQA hopes that centres find these exemplars useful in giving a feel for the new style of questions that will appear from 2009 in the pilot, and in national examinations from 2010 onwards.

A full set of Specimen papers for 2009 GCSE pilot examinations will be produced and made available to pilot centres in October 2008.

.

There are no questions printed on this page

Answer **all** questions in the spaces provided.

1 A home owner pays £ 70 per month for gas.

At the end of the year the gas company works out whether she has paid too much or too little.

If she pays too much she gets a refund.

If she pays too little she has to pay the extra.

Her total gas bill for the year is £ 1083.25

Work out the refund or the extra amount to be paid.

……..……

……..……

……..……

……..……

……..……....

……..……

Answer £ ….…… *(4 marks)*

Question 1	**Unit 2 Calculator**	**Tier F**	**Grade E**

Q	**Answer**	**Mark**	**Comments**
1	12 × 70	M1	
	840	A1	
	1083.25 – Their 840	M1dep	
	£ 243.25	A1	

Notes

A straightforward number question set in a simple real context. There are some decisions for the candidate to make and, because of the context, there are more words in the question.

This makes the question more demanding for foundation tier candidates and so it is considered Grade E because of the wording and required reasoning.

2 The table shows the charges by a hire company for a carpet cleaner and an attachment.

Code	Item	1st Day	Additional	Weekend	Week
58302	Carpet Cleaner - Small	£24.50	£12.25	£30.63	£49.00
58309	Upholstery Attachment (domestic)	£2.50	£1.25	£3.13	£5.00

2 (a) How much does it cost to hire the cleaner for 3 days?

……..…….……..

……..…….……..

……..…….…..

Answer £….……..…… *(2 marks)*

2 (b) How much cheaper is it to hire the cleaner and attachment for a weekend than for two days in the week?

……..…….……..

……..…….……..

……..…….…..

……..…….……..

……..…….……..

……..…….……..

……..…….……..

Answer £….……..…… *(4 marks)*

Question 2	Unit 2 Calculator	Tier F	Grade E

Q	Answer	Mark	Comments
2(a)	24.5(0) + 2 × 12.25	M1	oe
	49	A1	
2(b)	24.50 + 12.25 + 2.5(0) + 1.25	M1	
	30.63 + 3.13	M1	
	(24.50 + 12.25 + 2.5(0) + 1.25) – (30.63 + 3.13)	M1dep	
	6.74	A1	

Notes

This question is based on real data but an extract has been taken rather than presenting a large table as we might in a Functional Mathematics assessment. A slight re-casting of the question could make it suitable for Unit 3 (formulae expressed in words). One rule of thumb for functional questions is that one can imagine somebody wanting to know the answer. This question passes that test.

3 (a) Complete the sentence.

1 gallon is equivalent to …… litres.

(1 mark)

3 (b) A farmer states that his tractor uses 5 gallons of fuel per hour when ploughing.

3 (b) (i) Work out the number of litres used when ploughing for 4 hours.

……..……..…….

……..……..…….

……..……..…….

……..……..…….

……..……..…….

Answer ……..…… litres *(2 marks)*

3 (b) (ii) Fuel costs £1.10 per litre.

Work out the cost of the fuel used.

……..……..…….

……..……..…….

……..……..…….

Answer £……..…… *(2 marks)*

Question 3	**Unit 2 Calc or Non-calc**	**Tier F**	**Grade E / F**

Q	**Answer**	**Mark**	**Comments**
3(a)	4.5	B1	
3(b)(i)	5 × 4.5 × 4	M1	oe
	90	A1	
3(b)(ii)	Their 90 × 1.1(0)	M1	
	99	A1	

Notes

This is an example of using and applying a conversion that candidates are required to know. It is a fairly conventional question that may have been asked on a GCSE paper in the past.

4 The table shows the national minimum wage for people of different ages.

Age	Hourly rate
22 years and over	£5.25
18 - 21	£4.60
16 - 17	£3.40

Tom is an 18 year old student.

He works part time for 12 hours each week and is paid the national minimum wage.

Tom saves $\frac{1}{4}$ of his earnings each week so that he can buy an MP3 player.

How many weeks does Tom have to save so that he can buy the MP3 player?

You **must** show your working.

……..……..

……..……..

……..……..

……..……..

……..……..

……..……..

Answer ……..…… *(4 marks)*

Question 4	Unit 2 Calculator	Tier F	Grade E

Q	Answer	Mark	Comments
4	12 × 4.6(0) or 55.2(0)	M1	12 ÷ 4 or 3
	55.2(0) ÷ 4 or 13.8(0)	M1	3 × 4.6(0) or 13.8(0)
	132 ÷ Their 13.8 or 9.5(...)	M1	
	10 weeks	A1	

Notes

Contexts involving earning and saving are very suitable for functional questions in Unit 2. The specimen question on a similar topic in Functional Mathematics involved much more data and more questions on the theme. This question shows the difference in approach on GCSE. This is based on an old GCSE question where the numbers were simpler.

5 The table shows the cost of a **single room** at a hotel.

	Cost per night per person	
Day	Friday to Sunday	Monday to Thursday
Low Season	£70.00	£110.00
High Season	£88.00	£138.00

5 (a) Bill stays at the hotel for three nights in low season.
He arrives on Monday.

How much does he pay for his room?

……..……..

……...……..

Answer £…….…… *(2 marks)*

5 (b) Katie stays at the hotel for three nights in the high season.
She arrives on Sunday.
How much does she pay for her room?

……..……..

……...……..

Answer £…….…… *(2 marks)*

5 (c) This table shows the cost of a **double room** at the hotel.

	Cost per night per person	
Day	Friday to Sunday	Monday to Thursday
Low Season	£35.00	£55.00
High Season	£45.00	£70.00

Breakfast at the hotel costs £11.50 per person.

Mr and Mrs Smith stay in a double room at the hotel for two nights in the high season.
They arrive on Thursday and leave on Saturday morning.
They eat breakfast at the hotel on Friday morning only.
Complete the following bill for their stay.

Day	Cost of room (£)	Cost of breakfast (£)	Total Cost (£)
Thursday			
Friday			

(3 marks)

Question 5	Unit 2 Calc or Non-calc	Tier F	Grade D / E / F

Q	Answer	Mark	Comments
5(a)	110 × 3	M1	
	(£) 330(.00)	A1	**Not** (£) 330.0
5(b)	88 + 2 × 138	M1	
	(£) 364(.00)	A1	**Not** (£) 364.0 (Allow if notation already penalised)
5(c)	140 140 90 23 113 253	B3	–1eeoo

Notes

The data presented for this question is real but is very much simpler than would be used in Functional Mathematics assessments where a real Hotel price list could be given, possibly as pre-release data. The final part of this question requires candidate to consider a number of conditions and because of this, examiners see it as a grade D question.

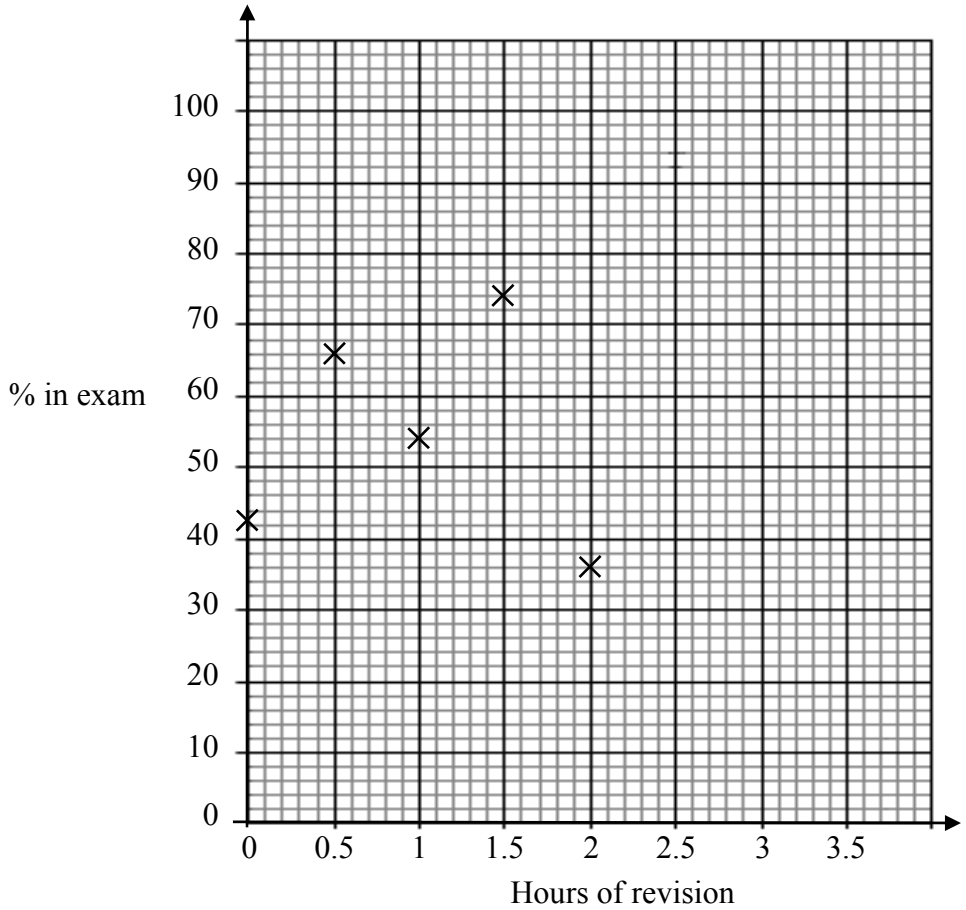
6 A teacher is trying to show that pupils who get higher marks in an examination revise more the night before.

He obtains this data from 10 pupils.

Pupil	A	B	C	D	E	F	G	H	I	J
Hours of revision	1	2	1.5	0.5	0	3	3.5	1	0.5	2
Percentage in exam	54	26	74	66	43	88	65	30	51	67

6 (a) Complete the scatter graph to show the data.

The first five points have been plotted for you.



(2marks)

6 (b) Draw a line of best fit on the scatter graph. *(1 mark)*

6 (c) What strength and type of correlation is shown in the diagram.

Answer …… *(2 marks)*

6 (d) Barry revised for two and a half hours the night before the exam.

Use your line of best fit to estimate his percentage in the test.

Answer ..…… % *(3 marks)*

6 (e) The teacher wrote a sentence to summarise his findings.

Complete the sentence by filling in the missing words.

"If you do more revision the night before the exam you will do ..... in the exam.

This is true ..... of the time". *(2 marks)*

6 (f) Give **one** possible reason why the teacher did **not** get evidence of the effect of revision on exam performance.

……...……

……...……

……...……

(1 mark)

Question 6	**Unit 2 Non-calculator**	**Both Tiers**	**Grade C / D**

Q	Answer	Mark	Comments
6(a)	Remaining 5 points correct	B2	B1 3 or 4 correct points
6(b)	Appropriate line of best fit	B1	
6(c)	Weak	B1	
	Positive	B1	
6(d)	ft Their line of best fit	B1ft	$\frac{1}{2}$ small square tolerance
6(e)	Better	B1	oe Accept well
	Some	B1	oe eg, much
6(f)	Sample was quite small or, No indication of abilities of those surveyed (result might be more down to ability than revision) or, Only considered revision night before - could have done much previously (or not)	B1	Accept equivalent or other sensible answers

Notes

The questions here are fairly standard for a GCSE but the context is extended so that the individual calculations are done with a purpose. The question is well structured to be accessible to candidates. If this context were used in a Functional Mathematics assessment, some of the structure could be removed and more choice of approach given to candidates.

7 Kirton Council wants to close down the fire station in the village**.**

Sam is concerned that fires in the village will take longer to be attended to if the station closes.

For one month, the time taken in minutes by the fire engine to reach a fire in the village is recorded.

3 5 1 2 5 7 5 2 5 5

7 (a) Work out the mean time taken.

……...……..

……...……..

Answer .....…… minutes *(2 marks)*

7 (b) Work out the median time taken.

……...……..

Answer .....…… minutes *(2 marks)*

7 (c) A quick response is defined as reaching a fire in under 5 minutes.

What percentage of these times represents a quick response?

……...……..

……...……..

Answer ...…….…… % *(2 marks)*

7 (d) The council closes the fire station for one month.

In this month there are 8 fires.

The times taken in minutes for the fire engine to reach the fires are:

6 4 7 4 8 8 4 7

7 (d) (i) The council say that the modal time for the fire engine to reach fires in the village is now quicker than before.

Explain why the council is correct.

……...……...……

……...……...……

……...……...……

(2 marks)

7 (d) (ii) Sam says "If you look at the mean and median, the times are slower."

Is Sam correct?

You **must** show your working.

……..……..……

……..……..……

……..……..……

……..……..……

(3 marks)

7 (d) (iii) The council decides to re-open the station if the percentage of quick responses has decreased while it was closed.

Will the fire station re-open?

You **must** show your working.

……..……..……

……..……..……

Answer ……..…… *(3 marks)*

Question 7	**Unit 2 Calculator**	**Tier F**	**Grade C / D / E**

Q	Answer	Mark	Comments
7(a)	Adds up data and divides by 10	M1	40 ÷ 10
	4	A1	
7(b)	Orders data and attempts to find middle	M1	
	5	A1	
7(c)	40	B2	B1 Sight of 4 out of 10 oe
7(d)(i)	Mode is now 4	B1	
	Before the mode was 5	B1	
7(d)(ii)	Mean is now 6	B1	
	Median is now 6.5	B1	
	Sam is correct	B1	

Q	Answer	Mark	Comments
7(d)(iii)	Now 3 out of 8 are quick	M1	
	$\frac{3}{8} \times 100$	M1	
	37.5 so fire station stays open	A1	

Notes

The calculations are simple but they are used to make inferences and to provide an argument. Again, the individual part questions are done for a purpose. Extending a context into a 14 mark question, as here, would need careful consideration in a 'live' paper with a total of only 50 marks. AQA will strive to find a balance between purposeful questions testing process skills and the potential risks of very long questions in short GCSE units.

Turn over for the next question

8 Niles owns a small garage with a shop.

He wants to find out whether people spend more when it is sunny than when it is raining.

The table shows the amount spent per person in the shop on 50 sunny days last year.

Amount spent on sunny days	**Frequency**
Under £5	28
£5 to under £10	14
£10 to under £15	5
£15 to under £20	3

8 (a) Use the table to calculate an estimate of the mean amount spent per person on a sunny day.

……..……..

……...……..

……..……..

……...……..

Answer £ ….……..…… *(4 marks)*

8 (b) Use the table to work out what percentage of these people spent under £10.

……..……..

……...……..

……..……..

Answer ...……..…… % *(3 marks)*

8 (c) The mean amount spent per person over 50 rainy days was £3.20

The range of the amount spent per person was £21.50

The percentage of people spending under £10 on these rainy days was 82%.

Compare the amounts spent per person on sunny days and rainy days.

……..……..

……...……..

……..……..

(3 marks)

8 (d) Niles checked his takings and found that they were actually higher on rainy days.

Explain how this is possible.

……..…….……..

(1 mark)

Question 8	**Unit 2 Calculator**	**Tier H**	**Grade B/C**

Q	**Answer**	**Mark**	**Comments**
8(a)	Attempts to use midpoints	M1	
	All midpoints correct and at least one correct *fx* value	M1dep	
	Max 1 error in *fx* and divide by 50	M1	290 ÷ 50
	5.80	A1	5.8 no working is M3A0
	Amount Spent (£) (*x*) / **Frequency (*f*)** / **midpoint** / ***fx***		
	Under 5 / 28 / 2.5(0) / 70		
	5 to under 10 / 14 / 7.5(0) / 105		
	10 to under 15 / 5 / 12.5(0) / 62.5		
	15 to under 20 / 3 / 17.5(0) / 52.5		
8(b)	$\frac{42}{50}$	M1	
	$\frac{42}{50} \times 100$	M1dep	
	84		
8(c)	The mean is smaller on a rainy day	E1	oe
	The range is bigger on a rainy day	E1	oe
	The % spending under £10 is about the same	E1	Accept that it is (slightly) smaller on a rainy day oe
8(d)	(Though they spend on average less) there must be more shoppers on a rainy day	E1	oe Anything sensible

Notes

This would be a Higher tier question which combines aspects of both Number and Statistics.

9 You can find out if your weight is healthy by working out your Body Mass Index (BMI).

Your BMI is worked out from your weight (W, kilograms) and height (h, metres) using this formula.

$$\text{BMI} = \frac{W}{h^2}$$

9 (a) Will's height is 1.63 m

He weighs 64 kg

Work out his BMI.

……..……...

……..……...

……...……..

Answer …….…… *(2 marks)*

9 (b) You can use your BMI to work out whether your weight is classified as underweight, healthy, overweight or obese as shown in the table.

Classification	**BMI range**
Underweight	Less than 18.5
Healthy	18.5 to 25
Overweight	25 to 30
Obese	Over 30

How is Will classified?

Answer …….……..…… *(1 mark)*

Question 9	**Unit 3 Calculator**	**Tier F**	**Grade C/D/G**

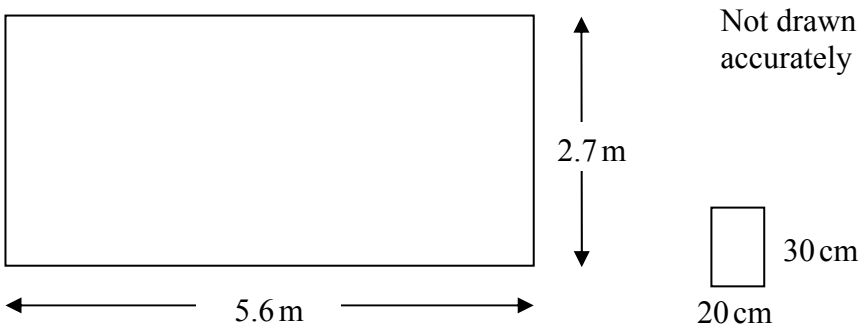
Q	**Answer**	**Mark**	**Comments**
9(a)	$64 \div 1.63^2$	M1	
	24, 24.1 or 24.(0 ...)	A1	
9(b)	Healthy	B1ft	

Notes

This question is based on a much longer task from a Functional Mathematics specimen assessment. In this GCSE question, the data is limited and the questions are closed and structured.

Turn over for the next question

10 The diagram shows a kitchen wall.



10 (a) The wall is to be tiled using rectangular tiles which are 20 centimetres wide and 30 centimetres high.

Work out the minimum number of tiles needed to cover the wall.

……...……...

……...……...

……...……...

……...……...

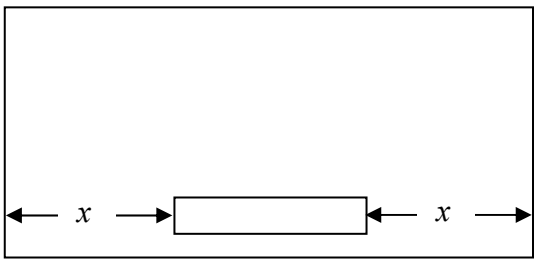
……...……...

……...……...

Answer ……..…… *(5 marks)*

10 (b) A radiator 1.8 metres long is fitted to the wall.

The radiator is the same distance from each end of the wall as shown.



Find the distance from each end, marked *x* on the diagram.

……...……...

……...……...

……...……...

Answer ……...…… metres *(3 marks)*

Question 10	Unit 3 Calculator	Both Tiers	Grade C / D

Q	Answer	Mark	Comments
10(a)	560 or 270	B1	
	560 ÷ 20 or 28	M1	560 × 270
	270 ÷ 30 or 9	M1	30 × 20 or 600
	Their 28 × Their 9	M1dep	Their (560 × 270) ÷ Their (30 × 20)
	252	A1	
10(b)	5.6 – 1.8	M1	
	Their (5.6 – 1.8) ÷ 2 or 3.8 ÷ 2	M1dep	
	1.9	A1	

Notes

This example shows a typical area for functional questions ie, life and work, leisure. As a GCSE question, it is fairly closed although there is a choice of method to be made and some reasoning is required. The content is straightforward and the information given is only what is needed to answer the question. If this question were on a non-calculator paper, candidates would be pushed towards the more efficient method so it is more likely to be on a calculator paper.

11 You can find out if your weight is healthy by working out your Body Mass Index (BMI).

Your BMI is worked out from your weight (W, kilograms) and height (h, meters) using this formula.

$$\text{BMI} = \frac{W}{h^2}$$

You can use your BMI to work out whether your weight is classified as underweight, healthy, overweight or obese as shown in the table.

Classification	**BMI range**
Underweight	Less than 18.5
Healthy	18.5 to 25
Overweight	25 to 30
Obese	Over 30

11 (a) Tom's height is 1.63 m

He weighs 72.8 kg

What is Tom's classification?

You **must** show your working.

……...……...

……...……...

……...……..

Answer ……..…… *(3 marks)*

11 (b) How much weight does Tom need to lose for his weight to be classified as Healthy?

……...……...

……...……...

……...……..

Answer ..…….…… kg *(3 marks)*

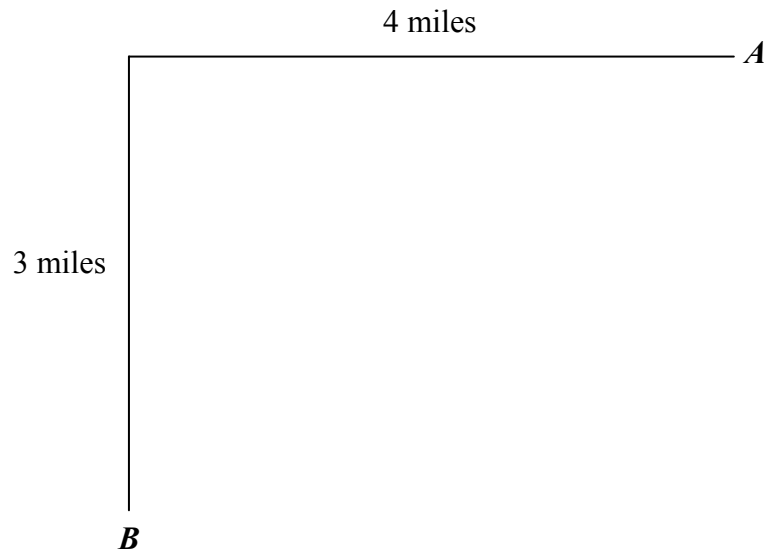
Question 11	Unit 3 Calculator	Tier H	Grade B

Q	Answer	Mark	Comments
11(a)	$72.8 \div 1.63^2$	M1	
	27.4(0 ...)	A1	
	Overweight	B1ft	
11(b)	$1.63^2 \times 25$	M1	or 66.4(2...)
	72.8 – Their 66.4(2...)	M1	
	6.4	A1	

Notes

This question addresses the same context as an earlier Foundation question but this one has less structure and is suitable for tier H. On Higher GCSE, it is reasonable to introduce technical demand beyond what is expected in Functional Mathematics assessments.

12 Town *A* is three miles North and 4 miles East of town *B* as shown.



12 (a) A walker takes a path from B to A.
The path is 6 miles long.

Use Pythagoras' theorem to explain how you know that the path is not a straight line.

……..……..

……..……..

……..……..

……..……..

(4 marks)

12 (b) The walker takes 1 hour 30 minutes.

Work out his average speed.

……..……..

……..……..

……..……..

Answer …….…… mph *(2 marks)*

Question 12	Unit 3 Non-calculator	Tier H	Grade B/C

Q	Answer	Mark	Comments
12(a)	$3^2 + 4^2$ or 9 + 16	M1	
	$\sqrt{3^2+4^2}$	M1dep	
	5	A1	
	Valid reason	B1ft	eg, $6 > 5$ $6 \neq 5$
12(b)	6 ÷ 1.5	M1	oe
	4	A1	

Notes

This is a novel and simple application of Pythagoras. Although the question is rather contrived, it does require reasoning and understanding of a simple model. As such, it addresses the functional process skills.

13 (a) Show that the area of a circle of diameter 10 inches is 78.5 square inches.

……..……..

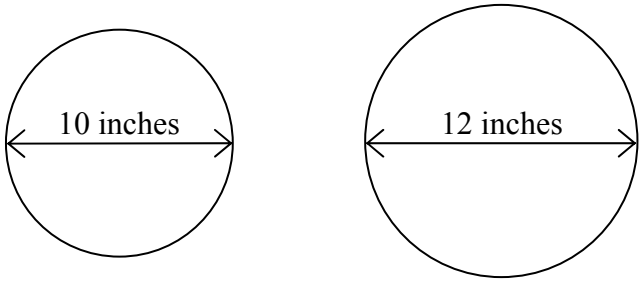
……..……..

……..……..

(2 marks)

13 (b) A circular 10 inch thin crust Margherita pizza costs £3.60

A circular 12 inch thin crust Margherita pizza costs £6.60



£3.60 £6.60

Which of these pizzas is the better value for money?

You **must** show your working.

……..……..

……..……..

……..……..

……..……..

(4 marks)

Question 13	**Unit 3 Calculator**	**Tier H**	**Grade B**

Q	**Answer**	**Mark**	**Comments**
13(a)	3.14×5^2	M1	
	3.14×25 (= 78.5)	A1	
13(b)	3.14×6^2	M1	or 113
	660 ÷ Their 113 or 360 ÷ Their 78.5	M1	oe
	5.84 and 4.58(9...) or 4.59	A1	
	10 inch	A1	

Notes

This type of question has been asked on GCSE papers in the past. It is essentially a difficult 'best value' question and requires the kind of reasoning which is needed in everyday life although only a confident mathematician would consider area ratios when ordering pizza! Without the hint of part (a), part (b) would probably not be very well answered.

There are no questions printed on this page