Mathematics

Additional Question Bank

Intermediate 2

5843

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HIGHER STILL

Mathematics

Additional Question Bank

Intermediate 2

Support Materials

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CONTENTS

1. INTRODUCTION

1.1 Background

The National Courses in Mathematics at Intermediate 2 and Standard Grade Credit Level are equivalent in standard with a high percentage of common content.
This Bank of Additional Questions for Intermediate 2 Mathematics consists mainly of questions taken from the SCE Mathematics Standard Grade Examination Papers at Credit Level for the years 1994 to 1999. Through the question paper moderation procedures of the Scottish Examination Board (SEB) (now Scottish Qualifications Authority (SQA)), the past paper questions in the Bank have already undergone scrutiny for clarity of language and mathematical accuracy. In addition, the difficulty levels attached to the questions are based on actual examination performance by candidates and the experience of examiners. Both of these factors have facilitated the speedy construction of an initial Bank of valid and reliable assessment instruments for the Intermediate 2 Mathematics course consisting of Mathematics 1(Int 2), Mathematics 2(Int 2) and Mathematics 3(Int 2). The statistical questions provided for Outcomes 3 and 4 in Mathematics 2 (Int 2), which have no Standard Grade equivalent, come from a variety of sources and have undergone careful selection and scrutiny.

1.2 Structure and purpose

The structure of the Bank is such that questions from future examinations for Intermediate 2 Mathematics and from other sources available to users can be categorised similarly and added to the Bank to allow for the construction of more tests with minimal repetition of questions.

The purpose of the Bank is to prepare students for course assessment and to generate evidence of attainment beyond the minimum competence necessary to pass the unit assessments for Intermediate 2 Mathematics. Centres are required to submit estimates of the bands candidates are likely to attain in the external course assessment and to retain the evidence of attainment on which estimates are based for use in the event of appeals. Following the guidelines below and using questions from this bank to obtain an assessment of the candidate's own unaided work should provide quality evidence of an estimate band. Centres may, of course, prefer to devise their own assessment materials, in which case modifying questions from the Bank or creating new questions based on contexts used in questions in the Bank may be helpful.

1.3 Quality of evidence

For assessment evidence in the form of prelim examinations or any other form of evidence to be fit for the purposes of estimates and appeals it is important that it covers as much of the course as possible. In Mathematics, evidence will normally be produced under supervision to ensure that it is the candidate's own unaided work. The following specification, which approximates to that used by SQA in the construction of the external assessment for Intermediate 2 Mathematics, is offered as a guide for the construction of internal course assessments in terms of breadth, depth and variety of assessment instruments.

Breadth: Maths 1(Int 2): Maths 2(Int 2): Maths 3(Int 2) or Appl (Int 2): cgd.

In assessment evidence, approximately 30% of the available marks should be allocated to questions or parts of questions based on the content of each unit with the remainder, approximately 10%, allocated to questions or parts of questions which meet the course grade descriptions (cgd) for Intermediate 2 Mathematics.
Approximately 20% of the available marks should be embedded in questions which integrate across the above categories.

Depth: grade C marks: grade A/B marks

In assessment evidence, approximately 60% of the available marks should be accessible to candidates capable of achieving a C grade in the external examination. The attainment of marks allocated to the A/B category is a good indication of a high level of mathematical ability. However it should be noted that the categorisation of C and A/B marks is intended to be used mainly for the construction of assessments. Judgements of ability can be arrived at on the basis of the total marks obtained by candidates on assessments of appropriate depth and duration. Evidence used for appeals purposes must be clearly supporting a grade i.e. A, B or C.

Variety of assessment instruments:

(a) non-calculator & calculator neutral : calculator & calculator neutral

The SQA Intermediate 2 Mathematics Specimen Question Paper I, in which calculators may not be used, contains questions which assess knowledge and skills that candidates should be able to demonstrate without the aid of a calculator. In Intermediate 2 Mathematics, for example, some questions assessing basic algebraic manipulation or of a graphical nature come into this category. Some questions in Paper 1 will require candidates to demonstrate non-calculator numerical skills as set out in the SQA National Course Specification for Intermediate 2 Mathematics. Additional questions of a calculator neutral variety top up the total marks available to 27 with a time allocation of 45 minutes.
Specimen Question Paper II, in which calculators may be used, contains those questions where a calculator is required, for example, to obtain numerical values of trigonometric ratios and to carry out numerical calculations beyond the level specified for the Non-calculator Paper. Additional questions of a calculator neutral variety top up the total marks available to 54, with a time allocation of 1 hour 30 minutes.
Assessment evidence need not conform exactly to this pattern, but it is important that non-calculator skills and the ability to perform sustained work are assessed.

(b) routine : non-routine

Similar to the questions used to assess the Knowledge and Understanding and the Reasoning and Enquiry elements used in Standard Grade Mathematics, there are assessment questions at Intermediate 2 which are of a routine nature and others of a non-routine nature. The routine questions assess the candidate's ability to carry out routine procedures and demonstrate knowledge

and understanding of basic facts and concepts. The non-routine questions require the candidate to demonstrate the ability to make decisions and apply knowledge and understanding to problem solving where the strategy is not obvious.
Across the two SQA Intermediate 2 Mathematics Specimen Papers, approximately 55% of the available marks are in questions or parts of questions which fit the routine category. The remaining marks, approximately 45%, are in non-routine questions.
Internal assessment evidence should have an approximately corresponding proportion of the marks embedded in non-routine questions.

1.4 Bank codes

In the following sections of this Additional Question Bank, codes are used for ease of reference. Mathematics 1(Int 2), Mathematics 2(Int 2), Mathematics 3(Int 2) and Applications of Mathematics (Int 2) are referred to as Unit 1, Unit 2, Unit 3 and Unit 4 respectively. A 3-figure code has been applied to the items of course content as listed in the National Course Specification for Intermediate 2 Mathematics. For example, 2.1.4 is the reference to the fourth item of content in the first outcome of unit 2. A code 0.1 has been used to classify content which falls into the category of course grade descriptions. In some instances there is no content item statement which exactly describes the mathematical activity being assessed and in such cases a related statement is used. For example, 1.2.1, find the volumes of spheres, cones and prisms also covers the situation where the volume is given and a dimension is to be found. Section 2 contains the full list of coded content for Intermediate 2 Mathematics in an abbreviated form. The document, SQA Mathematics Intermediate 2:National Course Specification should be consulted for a full statement of course content and comment and the course grade descriptions.

1.5 Additional questions

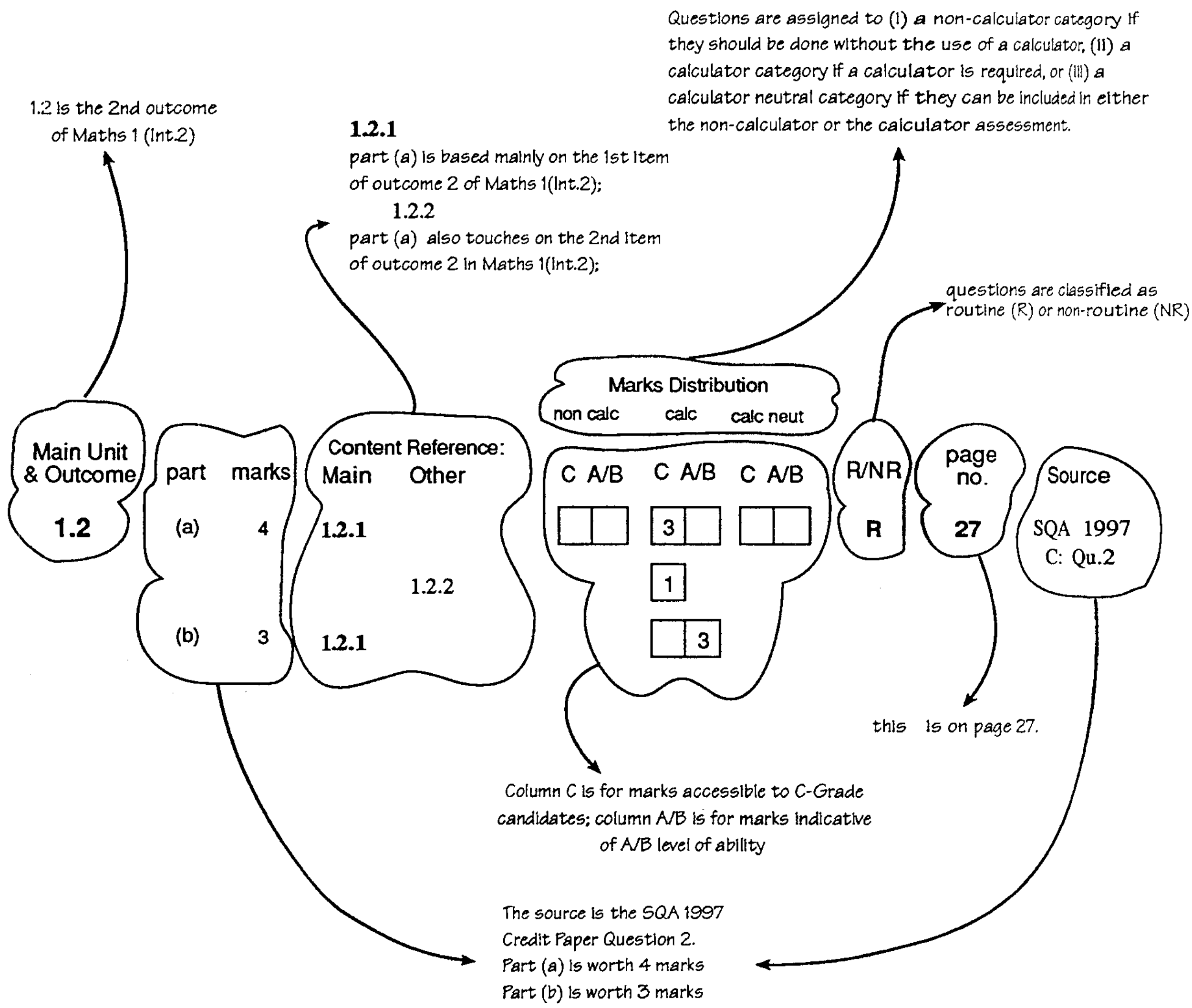
Section 3 of the Bank contains an analysis of the questions in grid form. Headings and abbreviations are explained on page 4.

Section 4 lists each of the questions with, as a guide to marking, a simplified version of the actual marking instructions used in the examinations. Only one method of marking is illustrated and it should be noted that, in many instances, alternative methods are equally valid.

1.6 Important limitations on use of the initial Bank

(i) The questions in this initial Bank were not constructed to satisfy the non-calculator external assessment arrangements which now apply. Consequently some questions which have been allocated a calculator neutral status may involve a level of computation higher than would normally be expected for inclusion in non-calculator papers. Users of the Bank can take account of this by minor alterations to such a question or by amending the marking scheme.
(ii) Since past examination papers for Standard Grade Credit Level Mathematics are in the public domain, it is important, for reliability, that internal course assessments are constructed with questions across the spread of years. For example, for an internal course assessment modelled on the Specimen Papers, a maximum of 3 questions should be selected from the Credit Level Paper for any year. Whilst the Bank is

relatively small, minor changes to questions, which do not change the characteristics of the question in terms of its analysis or level of difficulty should be considered.



SECTION 2

CONTENT REFERENCE LIST

Intermediate 2 Mathematics : Content Reference List

For a full statement of content and comments see SQA Mathematics Intermediate 1 : National Course Specifications

Unit 1 Outcome 1
1.1 Calculations involving %s

1.1.1 carry out calculations involving percentages in appropriate contexts: appreciation/depreciation

Unit 1 Outcome 2
1.2 Volumes of solids

1.2.1 find the volumes of spheres, cones and prisms
1.2.2 round calculations to a required number of sig. figs.

Unit 1 Outcome 3
1.3 Linear Relationships

1.3.1 find the gradient of a straight line between two points (x_1, y_1) and (x_2, y_2)
1.3.2 know that in the equation $y = ax + b$ of a straight line, 'a' represents the gradient and 'b' represents the intercept on the y-axis and use this to sketch the line without drawing accurately
1.3.3 determine the equation of a straight line in the form $y = ax + b$ from its graph

Unit 1 Outcome 4
1.4 Algebraic Operations

1.4.1 multiply algebraic expressions involving brackets
factorise algebraic expressions:
1.4.2 • common factor
1.4.3 • difference of two squares
• **diff of t.s. with numerical coefficients >1**
1.4.4 factorise trinomial expressions

Unit 1 Outcome 5
1.5 Properties of Circles

1.5.1 find the length of an arc of a circle
1.5.2 find the area of a sector of a circle
use the properties of circles:
1.5.3 • relationship between tangent and radius
1.5.4 • angle in a semi-circle
1.5.5 • **the interdependence of the centre, bisector of a chord and a perpendicular to a chord**

The statistical content of Mathematics 2 (Int 1) is underlined and should be integrated into the teaching of this unit. This content is required for progression purposes and will be assessed only as part of the overall statistical content.

Unit 2 Outcome 1
2.1 Trigonometry

2.1.1 find the sine, cosine and tangent of angles other than acute angles
2.1.2 find the area of a scalene triangle using area = $\frac{1}{2}bc\sin A$
2.1.3 solve scalene triangles by using the Sine /Cosine Rule
2.1.4 **use the Cosine Rule to find an angle of a triangle, given all three sides**

Unit 2 Outcome 2
2.2 Sim. Linear Equations

2.2.1 construct formulae to describe a linear relationship
2.2.2 know the significance of the point of intersection of two graphs: solve simultaneous linear equations in two variables graphically
2.2.3 solve simultaneous linear equations in two variables algebraically

Unit 2 Outcome 3
2.3 Simple graphs, charts, tables

(2.3.0) <u>extract and interpret data from bar graphs, line graphs, pie charts and stem-and-leaf diagrams</u>
(2.3.0) <u>construct bar graphs, line graphs and stem-and-leaf diagrams from given data</u>
(2.3.0) <u>construct and interpret a scattergraph from data</u>
2.3.1 add a cumulative frequency column for an ungrouped frequency table
2.3.2 find the <u>median</u> and quartiles from a data set or an ungrouped frequency table
2.3.3 construct and interpret boxplots and dotplots
2.3.4 construct a pie chart

Unit 2 Outcome 4
2.4 Use of simple statistics

(2.4.0) <u>calculate the mean, median, mode and range from a data set or an ungrouped frequency table</u>
2.4.1 calculate the semi-interquartile range from a data set or ungrouped frequency table
2.4.2 calculate the standard deviation of a data set
2.4.3 determine the equation of a best-fitting straight line on a scattergraph and use it to estimate a y-value given the x-value

2.4.4 know that probability is a measure of chance between 0 and 1
2.4.5 find probability defined as:

$$\frac{\text{no. of favourable outomes}}{\text{total no. of outcomes}}$$

where all the outcomes are equally likely

Unit 3 Outcome 1

3.1 Algebraic operations

3.1.1 reduce an algebraic fraction to its simplest form
3.1.2 apply the four rules to algebraic fractions
3.1.3 change the subject of formulae
3.1.4 simplify surds
3.1.5 **express with a rational denominator**
3.1.6 simplify expressions using the laws of indices

Unit 3 Outcome 2

3.2 Quadratic Functions

3.2.1 recognise quadratics of the form $y = kx^2$ and $y = (x+a)^2 + b;\ a,b \in \mathbb{Z}$ from their graphs
3.2.2 identify the nature and coordinates of the turning point and the equation of the axis of symmetry of a quadratic of the form $y = k(x+a)^2 + b;\ a,b \in \mathbb{Z},\ k = \pm 1$ including $y = kx^2$
3.2.3 know the meaning of the term 'roots of a quadratic equation'
3.2.4 solve quadratic equations graphically
3.2.5 solve quadratic equations by factorisation and by using the quadratic formula

Unit 3 Outcome 3

3.3 Further Trigonometry

3.3.1 recognise the graphs of sine, cosine and tangent functions
sketch and identify trigonometric functions
3.3.2 • involving a multiple angle
3.3.3 • **involving a phase angle**
3.3.4 solve simple trigonometric equations in degrees
3.3.5 define the period of a trigonometric function either from its graph or from its equation
3.3.6 **simplify expressions using $\sin^2 A + \cos^2 A = 1$ and $\frac{\sin A}{\cos A} = \tan A$.**

SECTION 3

QUESTION ANALYSIS

Main Unit & Outcome	part	marks	Content Reference: Main	Other	marks distribution: non calc C	non calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR	page no.	Source
0.1	.	4	0.1				4				NR	1	SQA 1994
													Credit Qu.3
0.1	(a)	1	0.1						1		R	2	SQA 1994
	(b)	3	0.1						1	2	NR		Credit Qu.4
0.1	.	4	0.1				3				NR	3	SQA 1994
				1.2.2			1				R		Credit Qu.7
0.1	.	4	0.1					4			NR	9	SQA 1994
													Credit Qu.20
0.1	.	3	0.1						3		NR	10	SQA 1995
													Credit Qu.5
0.1	(a)	4	0.1		4						R	11	SQA 1995
	(b)	2		1.3.3	2						R		Credit Qu.7
0.1	(a)	2	0.1						2		NR	13	SQA 1995
	(b)	2	0.1						2		NR		Credit Qu.10
0.1	(a)	1	0.1					4	1		R	17	SQA 1995
	(b)	3	0.1							3	NR		Credit Qu.19
	(c)	3		3.2.5						1	NR		
			0.1							2			
0.1	(a)	1	0.1						1		NR	20	SQA 1996
	(b)	2	0.1						2		NR		Credit Qu.7
0.1	(a)	1	0.1						1		NR	23	SQA 1996
	(b)	1	0.1						1		NR		Credit Qu.14
	(c)	2	0.1							2	NR		
0.1	(a)	2	0.1						2		NR	30	SQA 1997
	(b)	3	0.1						3		NR		Credit Qu.7
0.1	(a)	1	0.1						1		NR	34	SQA 1998
	(b)	2	0.1						2		NR		Credit Qu.2
0.1	(a)	1	0.1						1		NR	38	SQA 1998
	(b)	3	0.1							3	NR		Credit Qu.13
0.1	.	3	0.1							3	NR	39	SQA 1998
													Credit Qu.16
0.1	(a)	3	0.1					3			NR	40	SQA 1998
	(b)	3	0.1					3			NR		Credit Qu.18
0.1	.	3	0.1				2				R	42	SQA 1999
				1.2.2			1						Credit Qu.2

Main Unit & Outcome	part	marks	Content Reference : Main	Other	marks distribution: non calc C	non calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR	page no.	Source
0.1	(a)	1	0.1						1		NR	45	SQA 1999
	(b)	2	0.1						2		NR		Credit Qu.8
	(c)	3	0.1							3	NR		
0.1	(a)	2	0.1							2	NR	48	SQA 1999
	(b)	3	0.1	1.4.1						3	NR		Credit Qu.15
	(c)	3	1.4.2	0.1						2	NR		
				3.2.2						1			
0.1	(a)	2	0.1					2			NR	49	SQA 1999
	(b)	3	0.1					3			NR		Credit Qu.17
0.1		3	0.1						3		NR	59	SQA XXX
													Qu.11
0.1	(a)	3	0.1						3		NR	4	SQA 1994
	(b)	3	0.1						3		NR		Credit Qu.8
1.1		3	1.1.1				3				R	1	SQA 1994
													Credit Qu.2
1.1		4	1.1.1				3				NR	12	SQA 1995
				0.1			1						Credit Qu.8
1.1		4	1.1.1					4			NR	22	SQA 1996
													Credit Qu.12
1.1		3	1.1.1					3			R	29	SQA 1997
													Credit Qu.5
1.1		2	1.1.1				2				R	42	SQA 1999
													Credit Qu.1
1.2	(a)	1	0.1				1				R	34	SQA 1998
	(b)	3	1.2.1				3				R		Credit Qu.3
1.2		4	1.2.1						4		R	6	SQA 1994
													Credit Qu.14
1.2		4	1.2.1					3			NR	11	SQA 1995
				0.1				1			NR		Credit Qu.6
1.2		2	1.2.1						2		R	18	SQA 1996
													Credit Qu.2
1.2	(a)	4	1.2.1				3				R	27	SQA 1997
				1.2.2			1						Credit Qu.2
	(b)	3	1.2.1					3			NR		
1.2		4	1.2.1				4				R	46	SQA 1999
													Credit Qu.10

Main Unit & Outcome	part	marks	Content Reference : Main	Other	marks distribution: non calc C	non calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR	page no.	Source
1.2	.	3	1.2.2				1				R	19	SQA 1996
				0.1				2					Credit Qu.4
1.3	.	4	1.3.3						4		R	20	SQA 1996
													Credit Qu.8
1.3	.	3	1.3.3		3						R	35	SQA 1998
													Credit Qu.5
1.3	.	4	1.3.3			4					R	43	SQA 1999
													Credit Qu.5
1.4	(a)	2	1.4.1		2						R	3	SQA 1994
	(b)	2	1.4.4			2					R		Credit Qu.9
1.4	(a)	1	1.4.2		1						R	30	SQA 1997
	(b)	3	1.4.3		2						R		Credit Qu.8
				3.1.1	1								
1.4	.	2	1.4.4			2					R	44	SQA 1999
													Credit Qu.6
1.5	(a)	3	0.1				3				NR	35	SQA 1998
	(b)	4	1.5.1					3			NR		Credit Qu.7
				0.1				1					
1.5	.	4	1.5.1				4				NR	18	SQA 1996
													Credit Qu.3
1.5	.	3	1.5.1				3				R	27	SQA 1997
													Credit Qu.1
1.5	.	3	1.5.1				2				NR	45	SQA 1999
				0.1			1						Credit Qu.9
1.5	.	4	1.5.2				4				NR	5	SQA 1994
													Credit Qu.10
1.5	.	4	1.5.3					1			NR	29	SQA 1997
				0.1				3					Credit Qu.6
1.5	.	4	1.5.5					2			R	15	SQA 1995
				0.1				2					Credit Qu.14
1.5	.	4	1.5.5					4			R	36	SQA 1998
													Credit Qu.8
2.1	.	2	2.1.2				2				R	12	SQA 1995
													Credit Qu.9
2.1	.	4	2.1.2				2				NR	21	SQA 1996
				0.1			2						Credit Qu.9

Main Unit & Outcome	part	marks	Content Reference: Main	Other	marks distribution: non calc C	non calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR	page no.	Source
2.1		4	2.1.2				4				R	28	SQA 1997
													Credit Qu.4
2.1		4	2.1.3					4			NR	2	SQA 1994
													Credit Qu.5
2.1		4	2.1.3				4				R	6	SQA 1994
													Credit Qu.13
2.1		6	2.1.3					3			NR	14	SQA 1995
				0.1				3					Credit Qu.12
2.1		4	2.1.3				4				R	22	SQA 1996
													Credit Qu.11
2.1		6	2.1.3					3			NR	24	SQA 1996
				0.1				3					Credit Qu.15
2.1		6	2.1.3					3			NR	31	SQA 1997
				0.1				3					Credit Qu.12
2.1		3	2.1.3				3				R	37	SQA 1998
													Credit Qu.10
2.1		6	2.1.3					4			NR	38	SQA 1998
				0.1				2					Credit Qu.12
2.1		5	2.1.3				3				NR	43	SQA 1999
				0.1			2						Credit Qu.4
2.1		4	2.1.3				4				R	47	SQA 1999
													Credit Qu.14
2.2	(a)	2	0.1						2		NR	7	SQA 1994
	(b)	4	2.2.3							2	NR		Credit Qu.15
				0.1						2			
2.2	(a)	2	0.1						2		NR	10	SQA 1995
	(b)	3	2.2.1						3		NR		Credit Qu.3
2.2	(a)	2	0.1				2				NR	19	SQA 1996
	(b)	3	2.2.1				3				NR		Credit Qu.5
2.2	(a)	2	0.1						2		NR	25	SQA 1996
	(b)	4	2.2.3							2	NR		Credit Qu.17
				0.1						2			
2.2	(a)	1	0.1						1		R	32	SQA 1997
	(b)	2	0.1							2	NR		Credit Qu.14
	(c)	2	0.1							2	NR		
	(d)	3	2.2.3							3	NR		

Main Unit & Outcome	part	marks	Content Reference : Main	Other	marks distribution: non calc C	non calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR	page no.	Source
2.2	(a)	2	**0.1**						2		NR	**36**	SQA **1998**
	(b)	4	**2.2.1**							4	NR		Credit **Qu.9**
2.2	(a)	2	**0.1**		2						R	**44**	SQA **1999**
	(b)	3	**2.2.1**		3						NR		Credit **Qu.7**
2.2	(a)	2	**2.2.1**						2		NR	**5**	SQA **1994**
	(b)	4	**0.1**						4		NR		Credit **Qu.11**
2.2	(a)	2	**2.2.1**		2						NR	**15**	SQA **1995**
	(b)	2	**2.2.1**		2						NR		Credit **Qu.15**
	(c)	3	**2.2.3**		2						NR		
				0.1	1								
2.2	(a)	1	**2.2.1**						1		R	**28**	SQA **1997**
	(b)	2	**2.2.1**						2		R		Credit **Qu.3**
	(c)	4	**0.1**						4		NR		
2.2	(a)	2	**2.2.1**		2						R	**47**	SQA **1999**
	(b)	1	**2.2.1**		1						R		Credit **Qu.13**
	(c)	3	**2.2.3**		3						NR		
2.3	(a)	2	**2.4.1**						2		R	**53**	SQA **XXX**
	(b)	4	**2.3.3**						4		R		**Qu.5**
2.3	(a)	3	**2.3.3**						3		R	**50**	SQA **XXX**
	(b)	1	**2.4.1**						1		R		**Qu.1**
2.3	(a)	2	**2.3.3**							2	NR	**51**	SQA **XXX**
	(b)	2	**2.3.3**						2		R		**Qu.3**
2.3	(a)	1	**2.3.3**						1		R	**52**	SQA **XXX**
	(b)	3	**2.3.3**						3		R		**Qu.4**
	(c)	2	**2.3.3**							2	R		
2.3	.	4	**2.3.3**							3	R	**55**	SQA **XXX**
				2.4.1						1			**Qu.7**
2.3	.	5	**2.3.3**							5	R	**58**	SQA **XXX**
													Qu.10
2.3	.	4	**2.3.4**				2	2			R	**60**	SQA **XXX**
													Qu.12
2.3	.	3	**2.3.4**							3	R	**62**	SQA **XXX**
													Qu.16
2.4	(a)	2	**0.1**						2		R	**54**	SQA **XXX**
	(b)	4	**2.4.1**						3		R		**Qu.6**
				2.3.1					1				
2.4	.	4	**2.4.2**				1	3			R	**50**	SQA **XXX**
													Qu.2

Main Unit & Outcome	part	marks	Content Reference : Main	Other	marks distribution: non calc C	non calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR	page no.	Source
2.4	.	4	2.4.2				1	3			R	56	SQA XXX Qu.8
2.4	.	4	2.4.2				1	3			R	57	SQA XXX Qu.9
2.4	.	4	2.4.2				4				R	62	SQA XXX Qu.17
2.4	(a)	4	2.4.3				4				R	63	SQA XXX
	(b)	2	2.4.3				2				R		Qu.18
2.4	(a)	4	2.4.3						4		R	63	SQA XXX
	(b)	2	2.4.3						2		R		Qu.19
2.4	.	2	2.4.5						2		R	60	SQA XXX Qu.13
2.4	.	2	2.4.5				2				R	61	SQA XXX Qu.14
2.4	.	2	2.4.5		2						NR	61	SQA XXX Qu.15
3.1	(a)	3	3.1.2			3					R	9	SQA 1994
	(b)	2	3.1.5			2					R		Credit Qu.18
3.1	.	3	3.1.2			3					R	25	SQA 1996 Credit Qu.18
3.1	.	3	3.1.3							3	R	16	SQA 1995 Credit Qu.16
3.1	(a)	2	3.1.4			2					R	13	SQA 1995
	(b)	2	3.1.6			2					R		Credit Qu.11
	(c)	2	1.4.3			2					R		
3.1	(a)	2	1.4.4			2					R	21	SQA 1996
	(b)	3	3.1.3			3					R		Credit Qu.10
	(c)	2	3.2.5			2					R		
3.1	(a)	3	3.1.4			3					R	33	SQA 1997
	(b)	3	3.1.6			3					R		Credit Qu.15
3.1	(a)	2	1.4.4			2					R	40	SQA 1998
	(b)	2	3.1.2			2					R		Credit Qu.17
3.1	(a)	2	3.1.4			2					R	41	SQA 1998
	(b)	2	3.1.6			2					R		Credit Qu.19
3.1	(a)	1	3.1.4		1						R	48	SQA 1999
	(b)	2	3.1.6			2					R		Credit Qu.16
	(c)	3	1.4.1			3					R		

Main Unit & Outcome	part	marks	Content Reference : Main	Other	marks distribution: non calc C	non calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR	page no.	Source
3.1	(a)	3	3.1.6			3					R	24	SQA **1996**
	(b)	2	3.1.5			2					R		Credit **Qu.16**
	(c)	2	3.1.3			2					R		
3.2	(a)	1	0.1						1		NR	8	SQA **1994**
	(b)	3	0.1							2	NR		Credit **Qu.16**
				1.4.1						1			
	(c)	2	3.2.5							2	NR		
3.2	(a)	1	0.1		1						R	26	SQA **1996**
	(b)	2	0.1			2					NR		Credit **Qu.19**
	(c)	4	3.2.2			3					NR		
				1.4.2		1							
3.2	(a)	2	1.4.1		2						R	31	SQA **1997**
	(b)	3	3.2.5		3						R		Credit **Qu.11**
3.2	(a)	3	2.2.3		3						R	37	SQA **1998**
	(b)	2	3.1.3			2					R		Credit **Qu.11**
	(c)	3	3.2.5			3					R		
3.2	.	5	3.2.5				4				R	14	SQA **1995**
				1.2.2			1						Credit **Qu.13**
3.3	(a)	1	0.1					1			NR	33	SQA **1997**
	(b)	3	0.1					3			NR		Credit **Qu.16**
	(c)	3	3.3.3					3			NR		
3.3	.	3	3.3.4					3			R	8	SQA **1994**
													Credit **Qu.17**
3.3	.	3	3.3.4				3				R	23	SQA **1996**
													Credit **Qu.13**
3.3	.	3	3.3.4					3			R	39	SQA **1998**
													Credit **Qu.15**
3.3	.	3	3.3.4					3			R	46	SQA **1999**
													Credit **Qu.12**

SECTION 4

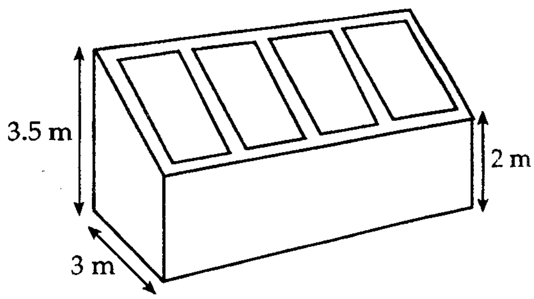
QUESTIONS BANK

The number of people suffering from a virus is 12 million.
For each of the next three years, the number of people suffering from the virus is expected to be 5% more than the number in the previous year.
How many people are expected to be suffering from the virus in three years time?
Give your answer in millions. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	1.1.1			3					R	**1994 Credit Qu. 2**

$12\times1.05^3=13.89$ *million*	•[1] $12\times$ •[2] 1.05^3 •[3] 13.89 million

The Scott family want to build a conservatory as shown.
The conservatory is to be 3 metres wide. The height of the conservatory at the lower end is to be 2 metres and at the higher end 3.5 metres.
To obtain planning permission, the roof must slope at an angle of $(25\pm2)^\circ$ to the horizontal.
Should planning permission be granted?
Justify your answer.

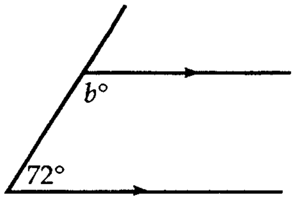


(4)

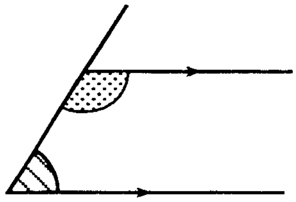
part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	0.1			4					NR	**1994 Credit Qu. 3**

•[1] *e.g.* r / a Δ with sides of 1.5 and 3
•[2] $\tan x^\circ = \frac{1.5}{3}$
•[3] $x = 26.6$
•[4] *yes*

The first diagram shows two parallel lines meeting a third line at 72°.



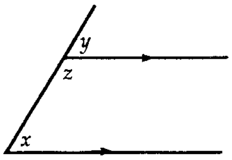
(*a*) Find the value of *b*. (1)



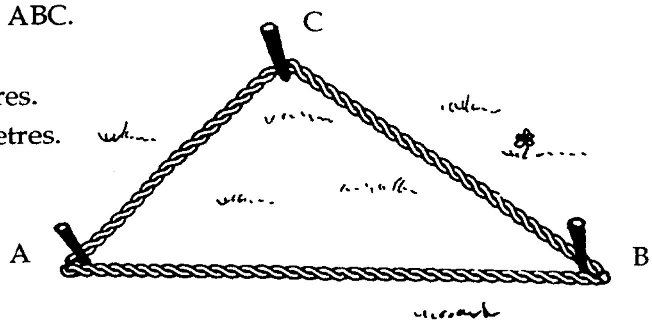
(*b*) The second diagram shows the general case of two parallel lines meeting a third line.
Prove that, in every case, the sum of the shaded angles is 180°. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1					1			R	**1994 Credit Qu. 4**
(b)	3	0.1					1	2		NR	

- •[1] $b = 108°$
- •[2] $x = y$
- •[3] $y + z = 180$
- •[4] $x + z = 180$



A loop of rope is used to mark out a triangular plot, ABC.
The loop of rope measures 6 metres.
Pegs are position at A and B such that AB = 2.5 metres.
The third peg is positioned at C such that BC is 2 metres.
Prove that ACB = 90°.
Do not use a scale drawing.



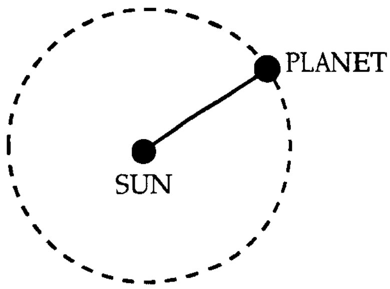
(4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	2.1.3				4				NR	**1994 Credit Qu. 5**

- •[1] $AC = 1.5$ metres
- •[2] $\cos ACB = \frac{2^2 + 1.5^2 - 2.5^2}{2 \times 2 \times 1.5}$
- •[3] $\cos ACB = 0$
- •[4] angle $ACB = 90°$

A planet takes 88 days to travel round the Sun.
The approximate path of the planet round the Sun is a circle with diameter 1.2×10^{7} kilometres.

Find the speed of the planet as it travels round the Sun.
Give your answer in kilometres per hour, correct to 2 significant figures.



(4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	0.1 1.2.2			3 1					NR	**1994 Credit Qu. 7**

- •1 $C = 3.14\times1.2\times10^{7}\ km$
- •2 $\text{Speed} = \dfrac{3.14\times1.2\times10^{7}}{88\times24}\ km/h$
- •3 $17840.9\ km/h$
- •4 $18000\ km/h$

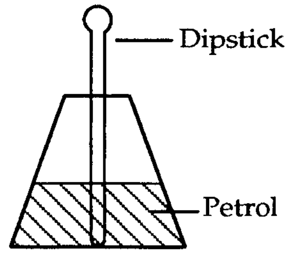
(*a*) Remove the brackets and simplify $(2y-3)^{2}$. (2)

(*b*) Factorise $2x^{2}+7x-4$. (2)

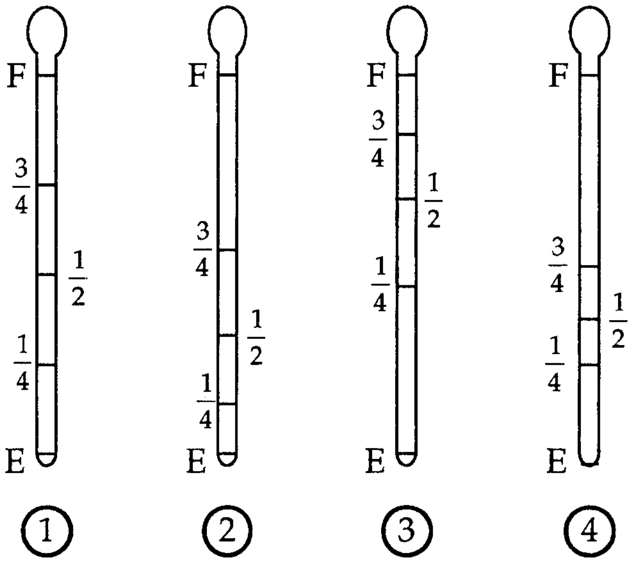
part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	1.4.1	2							R	**1994 Credit Qu. 9**
(b)	2	1.4.4		2						R	

- •1 $4y^{2}-6y-6y+9$
- •2 $4y^{2}-12y+9$
- •3 $(2x-1)\times\ldots$
- •4 $\ldots\times(x+4)$

The top diagram shows the cross-section of a petrol tank.
A dipstick is used to check the level of the petrol in the tank.

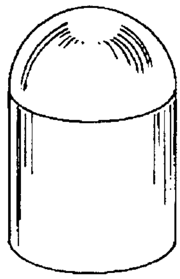


The dipstick has marks to show empty (E), quarter full $\left(\frac{1}{4}\right)$, half full $\left(\frac{1}{2}\right)$, three quarters full $\left(\frac{3}{4}\right)$ and totally full (F).



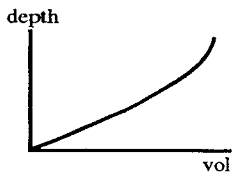
(*a*) Which dipstick , 1, 2, 3 or 4 should be used with the tank?
Explain your answer fully. (3)

(*b*) Here is another petrol tank.
Sketch a graph to show how the depth of the petrol varies with the volume of petrol in the tank. (3)

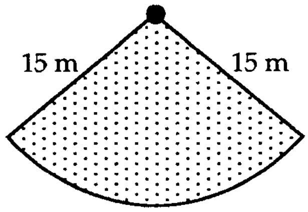


part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	3	0.1					3			NR	**1994 Credit**
(b)	3	0.1					3			NR	**Qu. 8**

- •[1] dipstick 2
- •[2] } explanation must relate spacings
- •[3] } on dipstick to volume of the tank
- •[4] labelling graph consisting of 2 sections
- •[5] linear section thr' O
- •[6] second section being concave up



A sensor in a security system covers a horizontal area in the shape of a sector of a circle of radius 15 m.
The area of the sector is 200 square metres.
Find the length of the arc of the sector. (4)



part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1994 Credit Qu. 10**
.	4	1.5.2			4					NR	

- •[1] ***strategy*** } attempt to calculate what fraction
- •[2] } the sector is of circle and use this fraction
- •[3] fraction of area of circle $= \dfrac{200}{\pi \times 15^2}$
- •[4] arc length $= \dfrac{200}{\pi \times 15^2} \times \pi \times 30 = 26.67\ m$

A cable car is used to carry sightseers up a mountain.
For safety reasons, the cable car company must consider the total weight of sightseers in the cable car.
They assume the average weight of an adult is 75 kilograms and the average weight of a child is 35 kg.

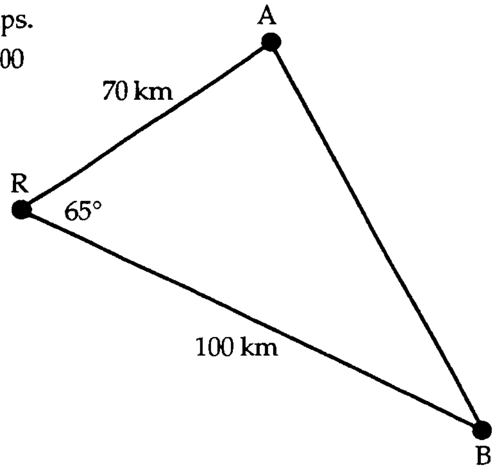
(*a*) Write down a formula for the **total** weight, W kilograms, of x adults and y children. (2)

(*b*) In the busy season the company sets the following conditions.
(i) 10 passengers must be carried at any one time.
(ii) Every child must be accompanied by at least 1 adult.
(iii) The maximum total weight which can be carried is 700 kilogarms.
List all the combinations of adults and children which can now be carried in the cable car to meet the above conditions.
Show all your working clearly. (4)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1994 Credit Qu. 11**
(a)	2	2.2.1					2			NR	
(b)	4	0.1					4			NR	

- •[1] $75x$ **and** $35y$
- •[2] $75x + 35y$
- •[3] *st*: consider at least one case – $x + y = 10$ **and** $x \le y$ whole **and** $x \ge y$
- •[4] produce at least two correct pairs
- •[5] produce 4 and only 4 correct values of x and y : 5,5 6,4 7,3 8,2
- •[6] *com:* 5 adults & 5 children, 6 ad & 4 ch, 7 ad & 3 ch, 8 ad & 2 ch

The diagram shows the position of an oilrig and two ships.
The oil rig at R is 70 kilometres from the ship at A and 100 kilometres from the ship at B. Angle ARB = 65°.

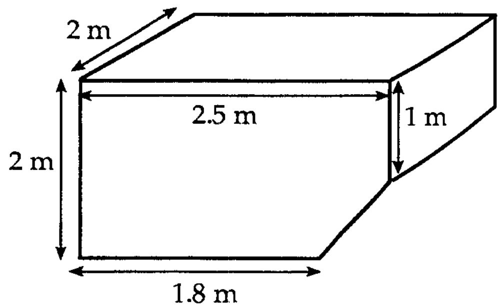


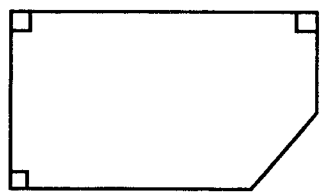
Calculate the distance AB.
Do not use a scale drawing. (4)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
.	4	2.1.3			4					R	1994 Credit Qu. 13

$AB^2 = 70^2 + 100^2 - 2\times 70\times 100\cos 65°$	•[1] *st:* for knowing to use cosine rule
$= 14900 - 5916.6556$	•[2] for correct substitution in correct formula
$= 8983.3443$	•[3] for $-5916.6556\ldots$
$AB = 94.7$	•[4] for AB (ignore rounding)
$= 95$	

A bottle bank is prism shaped, as shown in the diagram on the left.
The uniform cross-section is shown in the diagram on the right.



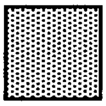


Find the volume of the bottle bank. (4)

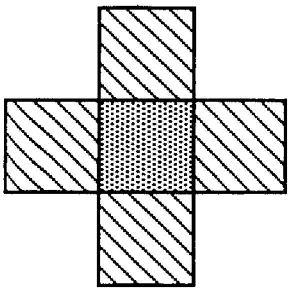
part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
.	4	1.2.1					4			R	1994 Credit Qu. 14

•[1] $3x + 4y$	•[5] valid strategy leading to values for x and y
•[2] $3x + 4y = 65$	•[6] $x = 7$ and $y = 11$
•[3] $5x + 7y$	•[7] 7g of iron and 11g of lead
•[4] $5x + 7y = 112$	

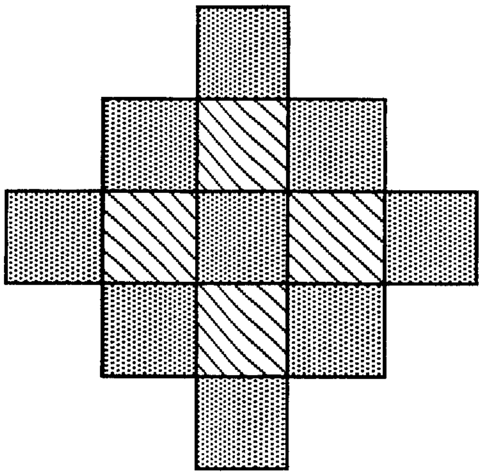
A large floor is to be covered with striped and grey square tiles to make a chequered patter.
The person laying the tiles must start at the centre of the floor and work outwards.
The instructions are as follows.



1st Arrangement



2nd Arrangement



3rd Arrangement

1 **Lay a grey tile in the centre of the floor.**

2 **Place striped tiles against the edges of the grey tile**

3 **Place grey tiles against the edges of all the striped tiles**

4 **Place striped tiles against the edges of all the grey tiles**

5 **and so on ......**

(*a*) How many tiles are there in the fourth arrangement? (2)

(*b*) The number of tiles, T, needed to make the Nth arrangement is given by the formula
$T = 2N^2 + aN + b$.
Find the values of a and b. (4)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1994 Credit**
(a)	2	0.1					2			NR	
(b)	4	2.2.3						2		NR	**Qu. 15**
		0.1						2			

$\bullet^1$ *st: e.g.* draw a table or next arrangement

$\bullet^2$ 25 *tiles* (this answer gains $\bullet^1$ *and* $\bullet^2$)

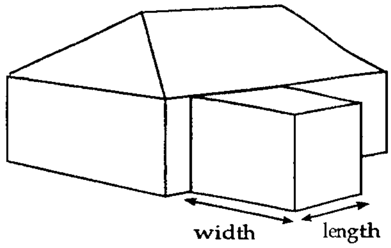
$\bullet^3$ $1 = 2 + a + b$

$\bullet^4$ $5 = 8 + 2a + b$

$\bullet^5$ *st:* solve the sim. equ's to yield values for a and b

$\bullet^6$ $a = -2,\ b = 1$

A family want to build an extension at the rear of their house. An architect advises that the extension should have its length 2 metres more than the width.



(a) If the width of the extension is w metres, write down an expression for its length. (1)

Planning regulations state that the area of the ground floor of the extension must not exceed 40% of the area of the ground floor of the original house.

(b) The ground floor of the original house is 12 metres by 10 metres.
Show that, if the largest extension is to be built, $w^2 + 2w - 48 = 0$. (3)

(c) Find the dimensions of the largest extension which can be built. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1					1			NR	**1994 Credit Qu. 16**
(b)	3	0.1						2		NR	
		1.4.1						1			
(c)	2	3.2.5						2		NR	

- •1 $w+2$
- •2 $area = 48$
- •3 $area = w(w+2)$
- •4 $w(w+2) = 48$ **leading to** $w^2 + 2w - 48 = 0$
- •5 *st: e.g.* $(w+8)(w-6) = 0$ **so** $w = 6$
- •6 *com:* dimensions of largest extension are 6m by8m

Solve the equation $5\sin x° + 2 = 0$, for $0 \le x \le 360$. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	3.3.4				3				R	**1994 Credit Qu. 17**

- •1 $\sin x° = -0.4$
- •2 $x = 203.6$
- •3 $x = 336.4$

(*a*) Express as a single fraction in its simplest form $\frac{3}{x}+\frac{2-x}{x^2}, \quad x \neq 0.$ (3)

(*b*) Express $\frac{3}{\sqrt{5}}$ as a fraction with a rational denominator. (2)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1994 Credit Qu. 18**
a)	3	3.1.2		3						R	
b)	2	3.1.5		2						R	

•1 $\frac{\cdots}{x^2}+\frac{\cdots}{x^2}$

•2 $\frac{3x}{x^2}+\frac{2-x}{x^2}$

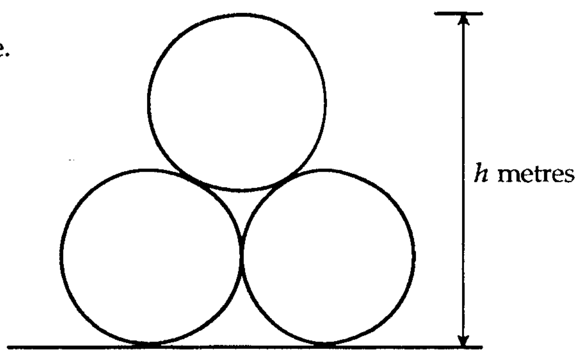
•3 $\frac{2x+2}{x^2}$

•4 $\frac{3}{\sqrt{5}}\times\frac{\sqrt{5}}{\sqrt{5}}$

•5 $\frac{3\sqrt{5}}{5}$

Three pipes are stored on horizontal ground, as shown.
Each pipe has circular cross-section with radius 1 metre.

Calculate the height, *h* metres, of the stacked pipes.
(Ignore the thickness of the pipes.)
Give your answer in metres, correct to two decimal places.



(4)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1994 Credit Qu. 20**
.	4	0.1				4				NR	

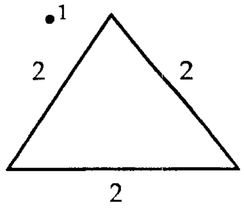
•1 for equilateral Δ

•2 *st:* find altitude (carried thr' to value for x)

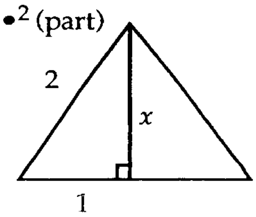
•3 $x^2=2^2-1^2 \Rightarrow x=1.73$

•4 $h=1.73+2=3.73$ m

•1



•2 (part)



The cost of sending a parcel depends on the weight of the parcel and the time of delivery.
The cost is calculated as shown below.

Time of delivery for next working day	Cost
by 10 am	**£18.20** for 10kg and £0.85 for each extra kg
by noon	**£13.50** for 10kg and £0.75 for **each extra kg**
by 5pm	**£10.50** for 10kg and £0.50 for **each extra kg**

(*a*) Find the cost of sending a parcel, of weight 14kg, for delivery **by noon** the next working day. (2)

(*b*) Write down a formula to find the cost, £*C*, of sending a parcel, of weight *w* kg, where *w* is greater than 10. The parcel has to be delivered **by noon** the next working day. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	0.1					2			NR	**1995 Credit Qu. 3**
(b)	3	2.2.1					3			NR	

•[1] £13.50

•[2] £13.50 + 4 × £0.75 = £16.50

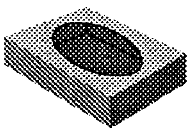
$C = 13.50 + 0.75(w - 10)$

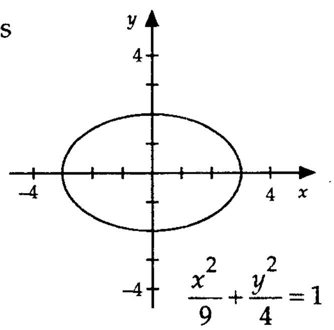
•[3] $w - 10$

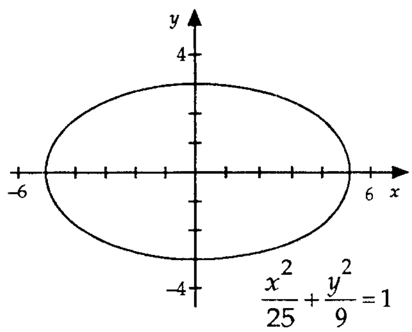
•[4] $0.75 \times (w - 10)$

•[5] 13.50 added to some expression in *w*

The opening on this box of tissues is in the shape of an ellipse.







The graphs of two ellipses and their equations are shown above.

Sketch the ellipse with equation $\frac{x^2}{36} + \frac{y^2}{16} = 1$. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	0.1					3			NR	**1995 Credit Qu. 5**

•[1] (6,0 **and** (−6,0)

•[2] (0,4) **and** (0,−4)

•[3] ellipse drawn correctly

Ground has to be blasted and removed so that a motorway can be widened. The existing motorway and the motorway after widening are shown here.

The uniform cross-section of the motorway consists of a rectangle and two congruent right-angled triangles as shown above. The cost of blasting and removing each cubic metre of ground is £4.
10 kilometres of existing motorway is to be widened.

Find the total cost of blasting and removing the ground. (4)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
.	4	1.2.1				3				NR	1995 Credit Qu. 6
		0.1				1					

- •[1] *strategy*: know area $=\left[5\times14+\frac{1}{2}\times10\times5\right]\text{m}^2$ **and** $\left[5\times22+\frac{1}{2}\times20\times5\right]\text{m}^2$
- •[2] *strategy*: know to subtract two volumes followed through to a final cost
- •[3] volume removed $= 650\ 000\ \text{m}^3$
- •[4] cost $=$ £2600000

A tank contains 10 litres of water.
A further 30 litres of water is poured into the tank at a steady rate of 5 litres per minute.

(*a*) On the 2mm square-ruled graph paper provided, draw a graph of the volume, V litres, of water in the tank against the time, t minutes. (4)

(*b*) Write down an equation connecting V and t. (2)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
(a)	4	0.1	4							R	1995 Credit Qu. 7
(b)	2	1.3.3	2							R	

- •[1] labelling axes
- •[2] $(t, V) = (0, 10)$
- •[3] st line graph correctly drawn and scaled
- •[4] $(t, V) = (6, 40)$

$V = 5t + 10$

- •[5] $5t$
- •[6] $+10$

The table shows the emission levels of harmful gases at different places in a city.

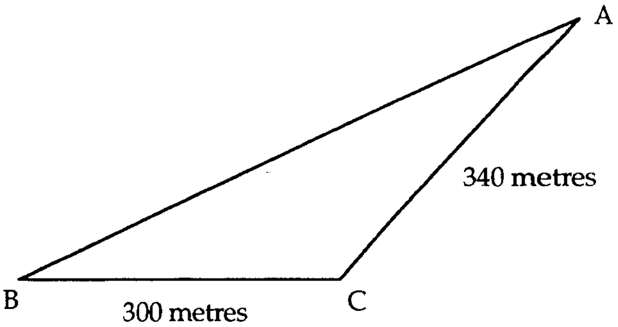
LOCATION	EMISSION LEVELS
City Sq	111 units
Albert Sq	41 units
Wellgate Centre	161 units
Bus Station	146 units
High St	114 units

Health regulations state that the emission levels of harmful gases should be less than 135 units. The city council plan to reduce the levels in such a way that for each of the next 3 years the emission levels will be 5% less than the level in the previous year.
Will all the places listed in the table meet the health regulations in 3 years time?
Show clearly all your working. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	1.1.1 0.1			3 1					NR	**1995 Credit Qu. 8**

- •[1] identifying 161
- •[2] *valid strategy*: $0.95^3 \times 161$
- •[3] *calc. based on valid strategy*: $0.95^3 \times 161 = 138$
- •[4] no (based on previous working)

A field, ABC, is shown here.



Find the area of the field. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	2	2.1.2			2					R	**1995 Credit Qu. 9**

- •[1] $A = \frac{1}{2}ab\sin C = \frac{1}{2} \times 300 \times 340 \times \sin 125°$
- •[2] $\frac{1}{2} \times 300 \times 340 \times \sin 125° = 41777$ (disregard rounding)

Brackets can be multiplied out in the following way.

$$(y+1)(y+2)(y+3) = y^3 + (1+2+3)y^2 + (1\times2+1\times3+2\times3)y + 1\times2\times3$$
$$(y+2)(y+3)(y+4) = y^3 + (2+3+4)y^2 + (2\times3+2\times4+3\times4)y + 2\times3\times4$$
$$(y+3)(y+4)(y+5) = y^3 + (3+4+5)y^2 + (3\times4+3\times5+4\times5)y + 3\times4\times5$$

(*a*) In the same way, multiply out $(y+4)(y+5)(y+6)$. (2)

(*b*) In the same way, multiply out $(y+a)(y+b)(y+c)$. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	0.1					2			NR	**1995 Credit Qu. 10**
(b)	2	0.1					2			NR	

- •[1] $(4+5+6)y^2$ **or** $(4\times5+4\times6+5\times6)y$
- •[2] $y^3+(4+5+6)y^2+(4\times5+4\times6+5\times6)y+4\times5\times6$
- •[3] $(a+b+c)y^2$ **or** $(a\times b+a\times c+b\times c)y$
- •[4] $y^3+(a+b+c)y^2+(ab+ac+bc)y+abc$

(*a*) $f(x) = 3\sqrt{x}$.
Find the exact value of $f(12)$, giving your answer as a **surd, in its simplest form**. (2)

(*b*) Express $\dfrac{y^4\times y}{y^{-2}}$ in its simplest form. (2)

(*c*) Factorise $9a^2-25$. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	3.1.4		2						R	**1995 Credit Qu. 11**
(b)	2	3.1.6		2						R	
(c)	2	1.4.3		2						R	

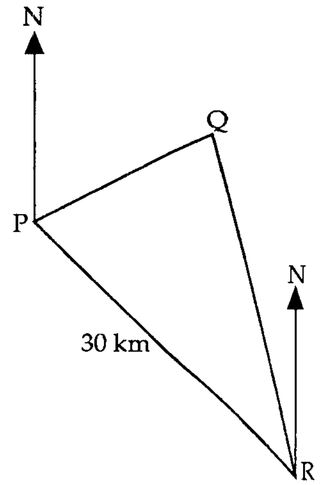
$\dfrac{y^4\times y}{y^{-2}} = \dfrac{y^5}{y^{-2}} = y^7$

$(3a-5)(3a+5)$

- •[1] $f(12) = 3\sqrt{12}$
- •[2] $= 6\sqrt{3}$
- •[3] y^5
- •[4] y^7
- •[5] $(3a-5)\times\ldots$
- •[6] $\ldots\times(3a+5)$

A ship, at position P, observes a lighthouse at position Q on a bearing of 040°.
The ship travels 30 kilometres on a bearing of 125° to position R.
From position R, the ship observes the lighthouse on a bearing of 340°.

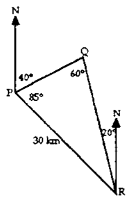
When the ship is at position R, how far is it from the lighthouse?



(6)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	6	2.1.3 0.1				3 3				NR	**1995 Credit Qu. 12**

- •[1] correct interpretation of one bearing
- •[2] $Q\hat{P}R = 125 - 40 = 85°$
- •[3] $P\hat{Q}R = 40 + 20 = 60°$



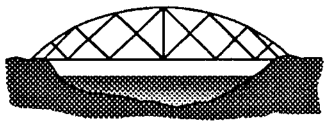
- •[4] *strategy*: *e.g.* know to use sine rule
- •[5] *apply strategy correctly*: $\frac{QR}{\sin 85°} = \frac{30}{\sin 60°}$
- •[6] *apply skills*: $QR = 34.5$

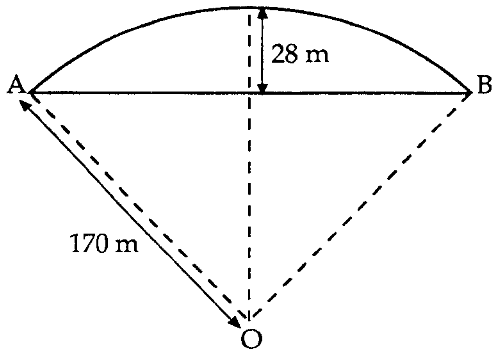
Solve the equation $x^2 + 2x - 6 = 0$.
Give your answers correct to 2 significant figures. (5)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	5	3.2.5 1.2.2			4 1					R	**1995 Credit Qu. 13**

- •[1] *strategy*: *e.g.* know to use quadratic formula
- •[2] $\frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times -6}}{2}$
- •[3] $\frac{\ldots \pm \sqrt{28}}{\ldots}$
- •[4] −3.646 **and** 1.646
- •[5] −3.6 **and** 1.6

The sketch below shows a road bridge.

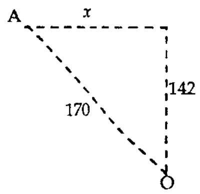




The curved part of the bridge is formed from an arc of a circle, centre O, as shown on the right.

OA and OB are radii of length 170 metres.
The height of the middle of the bridge above its ends is 28 metres as shown .
Calculate the horizontal distance, AB. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	1.5.5				2				R	**1995 Credit Qu. 14**
		0.1				2					



$$x^2 = 170^2 - 142^2$$
$$= 28900 - 20164$$
$$= 8736$$
$$x = 93.466$$
$$AB = 186.9$$

- •[1] 142
- •[2] *strategy*: *i.e.* $x^2 = 170^2 - 142^2$
- •[3] correct calculations $\Rightarrow x = 93.466\ldots$
- •[4] $AB = 186.9$ (disregard rounding)

Alloys are made by mixing metals. Two different alloys are made using iron and lead.

To make the first alloy, 3 cubic centimetres of iron and 4 cubic centimetres of lead are used. This alloy weighs 65 grams.	To make the second alloy, 5 cubic centimetres of iron and 7 cubic centimetres of lead are used. This alloy weighs 112 grams.

(*a*) Let x grams be the weight of 1 cubic centimetre of iron and y grams be the weight of 1 cubic centimetre of lead.
Write down an equation in x and y which satisfies the conditions for the first alloy. (2)

(*b*) Write down a second equation in x and y which satisfies the conditions for the second alloy. (2)

(*c*) Find the weight of 1 cubic centimetre of iron and the weight of 1 cubic centimetre of lead. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	2.2.1	2							NR	**1995 Credit Qu. 15**
(b)	2	2.2.1	2							NR	
(c)	3	2.2.3	2							NR	
		0.1	1								

- •[1] $3x + 4y$
- •[2] $3x + 4y = 65$
- •[3] $5x + 7y$
- •[4] $5x + 7y = 112$
- •[5] valid strategy leading to values for x **and** y
- •[6] $x = 7$ **and** $y = 11$
- •[7] 7g of iron and 11g of lead

$M = R^2t - 3$.

Change the subject of the formula to R. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	3.1.3						3		R	**1995 Credit Qu. 16**

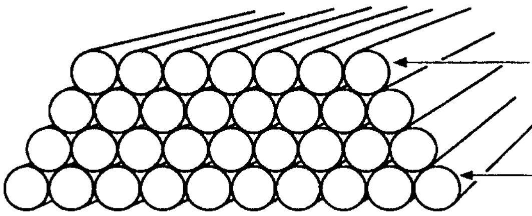
•1 $M + 3 = R^2t$

•2 $\frac{M+3}{t} = R^2$

•3 $\sqrt{\frac{M+3}{t}} = R$

Pipes with equal diameters are arranged in a stack.

To find the number of pipes, P, in a stack, the following formula can be used :-



$$P = \tfrac{1}{2}(b+a)(b-a+1)$$

where b is the number of pipes on the bottom row and a is the number of pipes on the top row.

(*a*) Use this formula to find the number of pipes in a stack where $b = 40$ and $a = 15$. (1)

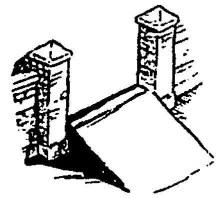
(*b*) In a particular stack, the number of pipes on the bottom row is twice the number on the top row. Show that in this stack $P = \tfrac{1}{2}(3a^2 + 3a)$ where a is the number of pipes on the top row. (3)

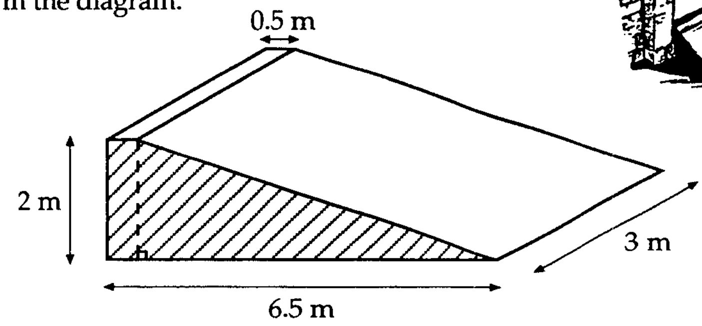
(*c*) Would it be possible to arrange exactly 975 pipes in the kind of stack described in part (*b*)? (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1					1			R	**1995 Credit** **Qu. 19**
(b)	3	0.1						3		NR	
(c)	3	3.2.5						1		NR	
		0.1						2			

- •1 $\tfrac{1}{2}(40+15)(40-15+1) = 715$
- •2 $b = 2a$
- •3 *valid strategy e.g.* substitute $2a$ for b
- •4 $\tfrac{1}{2}(2a+a)(2a-a+1) = \tfrac{1}{2} \times 3a(a+1) = \tfrac{1}{2}(3a^2+3a)$
- •5 $975 = \tfrac{1}{2}(3a^2+3a)$
- •6 *valid strategy followed thr':* *e.g.* $a^2 + a - 650 = 0$; $(a-25(a+26) = 0$ *so* $a = 25$
- •7 yes (supported and consistent)

A ramp is being made from concrete.
The uniform cross-section of the ramp consists of a right-angled triangle and a rectangle as shaded in the diagram.



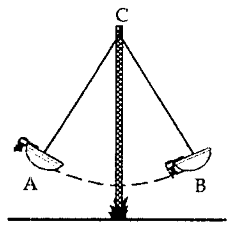


Find the volume of concrete required to make the ramp. (2)

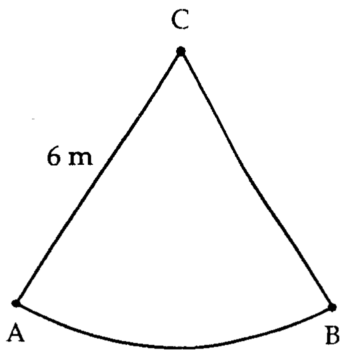
part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	2	1.2.1					2			R	**1996 Credit Qu. 2**

- •[1] *strategy*: *e.g.* vol = area of cross - section × depth
- •[2] *all calcs correct for strategy*: $(\frac{1}{2}\times2+\frac{1}{2}\times6\times2)\times3=7\times3=21$

The boat on a carnival ride travels along an arc of a circle, centre C.



The boat is attached to C by a rod 6 metres long.
The rod swings from position CA to position CB.
The length of the arc AB is 7 metres.

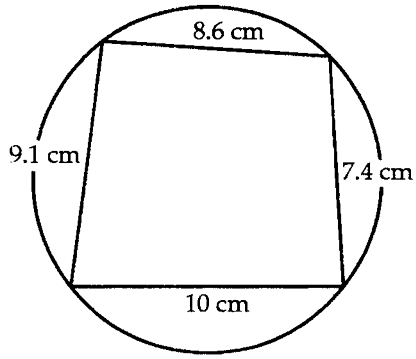


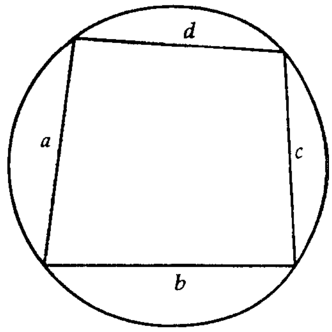
Find the angle through which the rod swings from position A to position B. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	1.5.1			4					NR	**1996 Credit Qu. 3**

- •[1]] *strategy*: express AB as fraction of circumference
- •[2]] **and** find same fraction of 360°
- •[3] $\frac{7}{12\pi}$
- •[4] $\frac{7}{12\pi}\times360°=66.9°$

The area, A, of a quadrilateral drawn inside a circle can be found using the formula $A=\sqrt{(s-a)(s-b)(s-c)(s-d)}$ where $s=\frac{1}{2}(a+b+c+d)$.





Use this formula to find the area of the quadrilateral shown in the diagram on the left. **Give your answer correct to 2 significant figures.** (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	0.1 1.2.2			2 1					R R	**1996 Credit Qu. 4**

- •[1] $S=17.55$
- •[2] $A=\sqrt{8.95\times10.15\times7.55\times8.45}$
- •[3] $76.1=76$

The travelling expenses claimed by a salesperson depend on the engine capacity of the car and the number of miles travelled per week as shown in the table below.

ENGINE CAPACITY	**EXPENSES PER MILE**
less than or equal to 1 litre	£0.25 for **each** of the first 250 miles travelled
greater than 1 litre but **less than or equal to** 1.2 litres	£0.27 for **each** of the first 250 miles travelled
greater than 1.2 litres	£0.29 for **each** of the first 250 miles travelled
Where the number of miles travelled in a week **is greater than 250,** £0.15 can be claimed for **each additional** mile.	

(*a*) Find the expenses claimed by a salesperson in a week when 550 miles are travelled and the engine capacity is 1.6 litres. (2)

(b) Write down a formula to find the expenses, £*E*, claimed for *t* miles travelled, where *t* is greater than 250, and the engine capacity is 1.6 litres. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	0.1			2					NR	**1996 Credit Qu. 5**
(b)	3	2.2.1			3					NR	

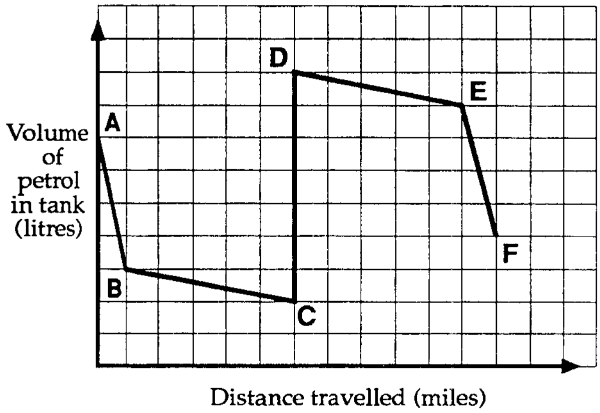
- •[1] $250\times£0.29$
- •[2] $300\times£0.15$ **and** £117.50

$E=35+0{\cdot}15t$

- •[3] $t-250$
- •[4] $0{\cdot}15(t-250)$
- •[5] for adding $72{\cdot}50$ to an expression for t

The graph shows the volume of petrol in a car's tank during a journey.

(*a*) Explain the significance of CD. (1)



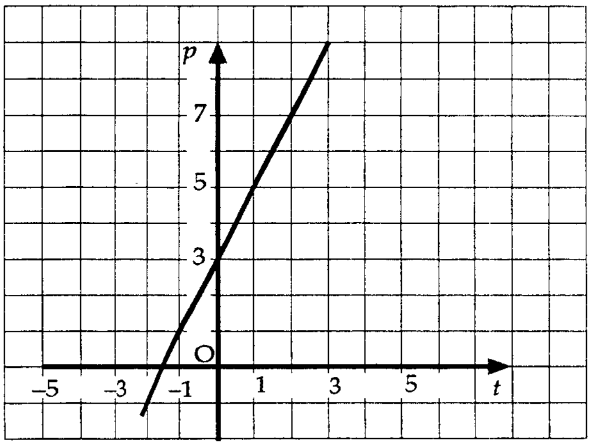
The journey involves driving through towns and along motorways.
In the towns the car uses more petrol per mile than on the motorways.

(*b*) Which **two** parts of the graph show driving on motorways?
Explain your answer clearly. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1					1			NR	**1996 Credit Qu. 7**
(b)	2	0.1					2			NR	

- •[1] petrol tank being filled
- •[2] *BC* **and** *DE*
- •[3] *e.g.* less fuel per mile being used **or** reference to gradients

Find the equation of the straight line in terms of p and t. (4)



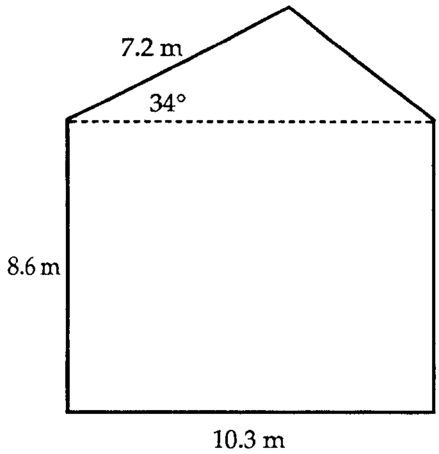
part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	1.3.3					4			R	**1996 Credit Qu. 8**

- •[1] *strategy*: use st line formula(c = intercept, m = gradient, stated / implied by •[2],•[3])
- •[2] intercept = 3
- •[3] gradient = 2
- •[4] $p = 2t + 3$ or equivalent

The side wall of a house, with measurements as shown, requires painting.

- The wall is in the shape of a rectangle and a triangle.
- On average, a litre of paint will cover 8 square metres.
- A painter estimates that he will require 12 litres of paint.

Will this be enough paint?
Justify your answer. (4)



part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	0.1 2.1.2 0.1			1 2 1					NR	**1996 Credit Qu. 9**

- •[1] *strategy*: Area of rectangle + area of triangle
- •[2] $8.6 \times 10.3 + 0.5 \times 10.3 \times 7.2 \sin 34°$ completed to give a value
- •[3] 109.31
- •[4] no (must be consistent with answer for •[3])

(*a*) Factorise $3x^2 - 5x - 2$. (2)

(*b*) Solve **algebraically** the equation $\frac{m}{3} = \frac{(1-m)}{5}$. (3)

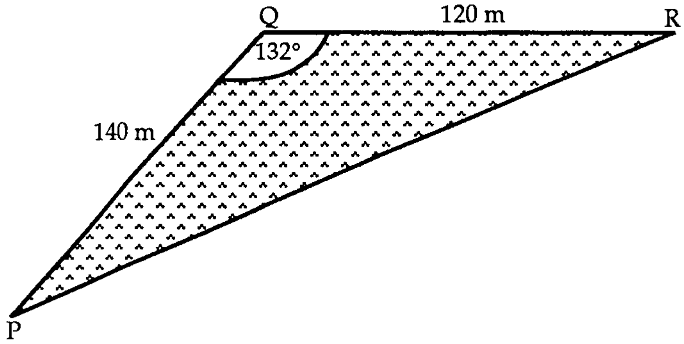
(*c*) Solve **algebraically** the equation $6y - y^2 = 0$. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	1.4.4		2						R	**1996 Credit Qu. 10**
(b)	3	3.1.3		3						R	
(c)	2	3.2.5		2						R	

- •[1] $(3x+1)\times\ldots$
- •[2] $\ldots\times(x-2)$
- •[3] *strategy*: *e.g.* $5m = 3(1-m)$
- •[4] $5m = 3 - 3m$
- •[5] $m = \frac{3}{8}$
- •[6] *strategy*: *e.g.* $y(6-y) = 0$
- •[7] $y = 0$ **and** $y = 6$

A triangular field, PQR, is shown here. PQ = 140 metres, QR = 120 metres and angle PQR = 132°.

Calculate the length of PR.
Do not use a scale drawing.



(4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	2.1.3			4					R	1996 Credit Qu. 11

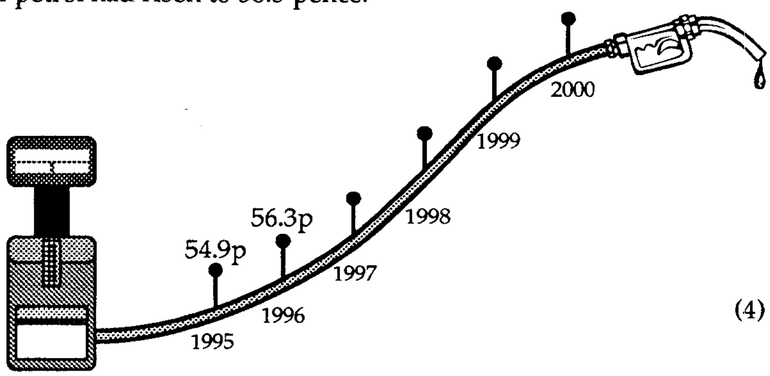
- •[1] *strategy*: *e.g.* use cosine rule
- •[2] $PR^2 = 140^2 + 120^2 - 2\times 140\times 120\times \cos 132°$
- •[3] $PR^2 = \ldots\ldots\ldots\ldots + 22482.8$

  $PR^2 = 56482.8$
- •[4] $PR = 238$

In 1995, the price of 1 litre of a certain kind of petrol was 54.9 pence.
By 1996, the price of 1 litre of the same kind of petrol had risen to 56.3 pence.

The percentage increase for each of the next four years is expected to be the same as the percentage increase between 1995 and 1996.

What is the price of 1 litre of petrol expected to be in the year 2000?



(4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	1.1.1				4				NR	1996 Credit Qu. 12

- •[1] *strategy*: % increase = ...
- •[2] $\frac{1.4}{54.9}\times 100 = 2.55\%$
- •[3] *strategy*: "2000" price = 56.3×1.0255^4
- •[4] 62.3

Solve **algebraically** the equation $5\tan x° - 9 = 0$, for $0 \le x < 360$. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	3.3.4			3					R	**1996 Credit Qu. 13**

•[1] $\tan x° = \frac{9}{5}$

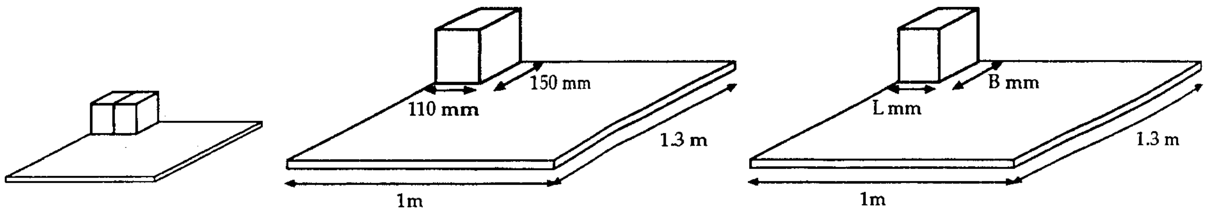
•[2] $x = 60.9$

•[3] $x = 240.9$

The integral part of a positive real number is the part of the number which is an integer.

EXAMPLES: The integral part of 5.6 is 5. This can be written as **[5.6] = 5.**
The integral part of 6.2 is 6. This can be written as **[6.2] = 6.**

(*a*) Find [16.7]. (1)



Identical boxes are packed the same way round on a board. (2 boxes are shown in the 1st diagram).

(*b*) The base of each box measures 150 mm by 110 mm. The board measures 1.3 m by 1 m.
The number of boxes which can fit along the 1.3 metre length is given by $\left[\frac{1300}{150}\right]$.
Find $\left[\frac{1300}{150}\right]$. (1)

(*c*) Write down an expression for the number of boxes which can be packed on the third board . (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1					1			NR	**1996 Credit Qu. 14**
(b)	1	0.1					1			NR	
(c)	2	0.1						2		NR	

•[1] 16

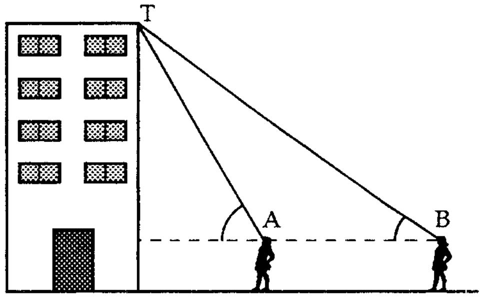
•[2] 8

•[3] no. along length $= \left[\frac{1300}{B}\right]$ **or** no. along breadth $= \left[\frac{1000}{L}\right]$

•[4] no. along length $= \left[\frac{1300}{B}\right]$ **and** no. along breadth $= \left[\frac{1000}{L}\right]$ **and** $\left[\frac{1300}{B}\right] \times \left[\frac{1000}{L}\right]$

The diagram shows two positions of a student as she views the top of a tower.

- From position B, the angle of elevation to T at the top of the tower is 64°.
- From position A, the angle of elevation to T at the top of the tower is 69°.
- The distance AB is 4.8 metres and the height of the student to eye level is 1.5 metres.



Find the height of the tower. (6)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	6	2.1.3 0.1				3 3				NR	**1996 Credit Qu. 15**

- •[1] $ATB = 5°$ stated or implied by •[3]
- •[2] *strategy*: *e.g.* use sine rule to produce a value for AT
- •[3] $\frac{TA}{\sin 64°} = \frac{4.8}{\sin 5°}$
- •[4] $TA = 49.5$
- •[5] *strategy*: *e.g.* use sine ratio for TC
- •[6] $TC = 46.2$ **and** *height* $= 47.7$

(*a*) Remove the brackets and simplify

$$b^{\frac{1}{2}}\left(b^{\frac{1}{2}} + b^{-\frac{1}{2}}\right).$$ (3)

(*b*) $f(x) = \frac{3}{\sqrt{x}}$.

Find the **exact** value of $f(2)$.
Give your answer **as a fraction** with a rational denominator. (2)

(*c*) $Q = p^2 + 3T$.
Change the subject of the formula to T. (2)

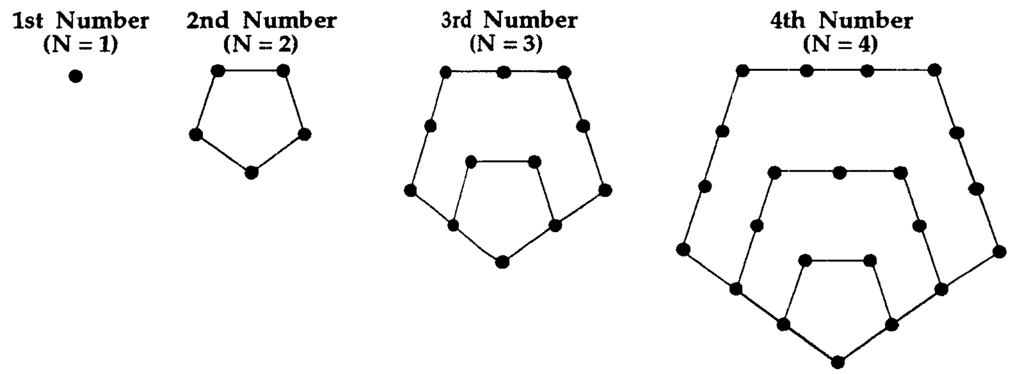
part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	3	3.1.6		3						R	**1996 Credit Qu. 16**
(b)	2	3.1.5		2						R	
(c)	2	3.1.3		2						R	

ans $b+1$

- •[1] b^1 (or b)
- •[2] b^0
- •[3] $b^0 = 1$
- •[4] $\frac{3}{\sqrt{2}}$
- •[5] $\frac{3\sqrt{2}}{2}$
- •[6] $Q - p^2 = 3T$
- •[7] $\frac{1}{3}\left(Q - p^2\right) = T$

A sequence of numbers is **1, 5, 12, 22, ...**

Numbers from this sequence can be illustrated in the following way using dots.



(*a*) What is the fifth number in this sequence?
Illustrate this in a sketch. (2)

(*b*) The number of dots, *D*, needed to illustrate the *N*th number in this sequence is given by the formula $D = aN^2 - bN$. Find the values of *a* and *b*. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	0.1					2			NR	**1996 Credit Qu. 17**
(b)	4	2.2.3						2		NR	
		0.1						2			

- •[1] 35
- •[2] correct sketch
- •[3] *e.g.* $5 = 4a - 2b$
- •[4] *e.g.* $12 = 9a - 3b$
- •[5] *strategy*: solve 2 equations leading to values for a and b
- •[6] $a = \frac{3}{2}$ **and** $b = \frac{1}{2}$

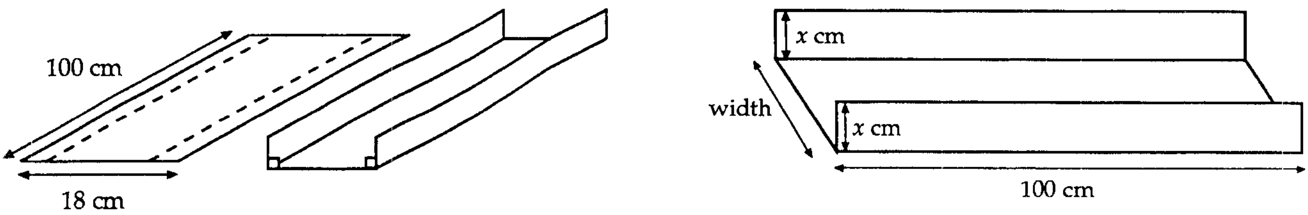
Express as a single fraction in its simplest form

$$\frac{5}{x} - \frac{3}{(x-2)}, \quad x \neq 0 \text{ or } 2$$

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	3.1.2		3						R	**1996 Credit Qu. 18(b)**

- •[1] $= \frac{\dots}{x(x-2)}$
- •[2] $= \frac{5(x-2) - 3x}{x(x-2)}$
- •[3] $= \frac{2x-10}{x(x-2)}$

A rectangular sheet of plastic 18 cm by 100 cm is used to make a gutter for draining rain water.
The gutter is made by bending the sheet of plastic as shown below in the first two diagrams below.



(*a*) The depth of the gutter is x centimetres as shown in the third diagram.
Write down an expression in x for the width of the gutter. (1)

(*b*) Show that the volume, V cubic centimetres, of this gutter is given by $V = 1800x - 200x^2$. (2)

(*c*) Find the dimensions of the gutter which has the largest volume.
Show clearly all your working. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1	1							R	**1996 Credit Qu. 19**
(b)	2	0.1		2						NR	
(c)	4	1.4.2		1						NR	
		3.2.2		3							

•[1] $18 - 2x$

•[2] $100 \times (18 - 2x) \times x$

•[3] *e.g.* $= 100(18x - 2x^2) = 1800x - 200x^2$

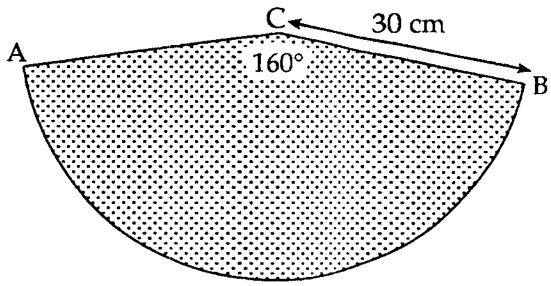
•[4] *strategy*:] any valid strategy followed through to

•[5]] produce a value of x for max. volume

•[6] (for maximum vol) $x = 4.5$

•[7] 4.5 *by* 9 (*by* 100)

The diagram shows a sector of a circle, centre C.
Angle ACB is 160° and the radius of the circle is 30 cm.

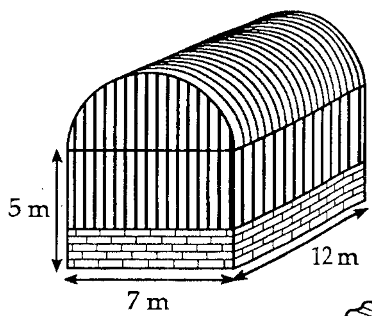


Calculate the length of the arc AB. (3)

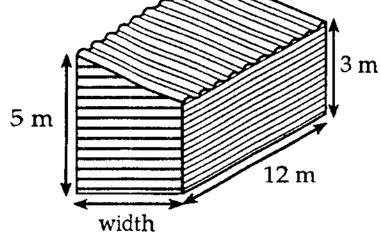
part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
	3	1.5.1			3					R	**1997 Credit Qu. 1**

- •[1] $\frac{160}{360}$
- •[2] circumference $= \pi \times 60$
- •[3] 83.7

A storage barn is prism shaped, as shown the top diagram. The cross-section of the storage barn consists of a rectangle measuring 7 metres by 5 metres and a semi-circle of radius 3.5 metres.



(*a*) Find the volume of the storage barn. Give your answer in cubic metres, **correct to 2 significant figures.** (4)



(*b*) An extension to the barn is planned to increase the volume by 200 cubic metres. The uniform cross-section of the extension consists of a rectangle and a right-angled triangle. Find the width of the extension. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	4	1.2.1			3					R	**1997 Credit Qu. 2**
		1.2.2			1						
(b)	3	1.2.1				3				NR	

- •[1] *strategy*] *e.g.* V = area of cross-section × length
- •[2]] and use this to find the volume
- •[3] $A = 54.24...m^2$ **and** $V = 650.88...$
- •[4] 650
- •[5] *strategy*] *e.g.* $3 \times w \times 12 + \frac{1}{2} w \times 2 \times 12 = 200$
- •[6]] leading to a value for w
- •[7] 4.2 *m*

While on holiday, John's family decide to hire a car.
There are two different schemes for hiring the same type of car, Eurocar and Apex.

EUROCAR HIRE
No deposit required
£15 per day

APEX HIRE
£50 deposit required
plus
£10 per day

(*a*) Write down a formula to find the cost, £C, of hiring the car from Eurocar for d days. (1)

(*b*) Write down a formula to find the cost, £C, of hiring the car from Apex for d days. (2)

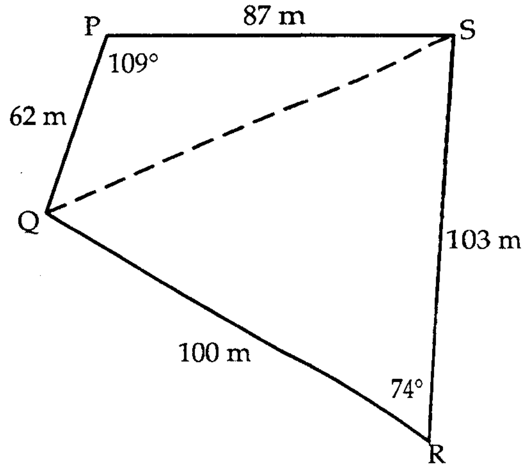
(*c*) John's family have £170 to spend on car hire.
Which scheme should they use to have the car for as long as possible?
Show clearly all your working. (4)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
(a)	1	2.2.1					1			R	**1997 Credit Qu. 3**
(b)	2	2.2.1					2			R	
(c)	4	0.1					4			NR	

- •[1] $C = 15d$
- •[2] $10d$
- •[3] (some expression in d) + 50
- •[4] 1st equation *ie* $15d = 170$
- •[5] 2nd equation *ie* $10d + 50 = 170$
- •[6] $11\frac{1}{3}$(or 11) days **and** 12 days
- •[7] comment: e.g. should use Apex

The sketch below shows a plot of ground, PQRS, split into two triangles.

Calculate the area of the plot of ground. (4)



part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
.	4	2.1.2			4					R	**1997 Credit Qu. 4**

- •[1] *strategy*: triangle + triangle
- •[2] $\frac{1}{2} \times 62 \times 87 \sin 109°$
- •[3] $\frac{1}{2} \times 100 \times 103 \sin 74°$
- •[4] 7500 (disregard rounding)

On a £500 holiday, a company offers an easy payment scheme.

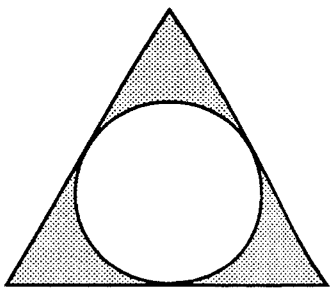
- £100 is paid on the 15th of each month.
- Interest is charged at a rate of 2.5% per month on the amount outstanding **at the end** of each month.
- The first payment is to be made in May.

The holiday is booked at the beginning of May.
Find the amount outstanding at the beginning of August. (3)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1997 Credit**
.	3	1.1.1				3				R	**Qu. 5**

- •[1] *strategy*: calculating 2.5% on a changing principal for 3 months
- •[2] $1.025 \times £400 = £410$ **and** $1.025 \times £310 = £317.75$
- •[3] $1.025 \times £317.75 = £223.19$

The diagram shows the design of an earring.



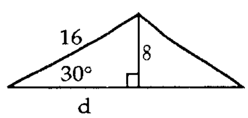
The earring consists of a circle placed inside an equilateral triangle.

- The sides of the triangle are tangents to the circle.
- The radius of the circle is 8 mm.
- The distance from the centre of the circle to **each** vertex of the triangle is 16 mm.

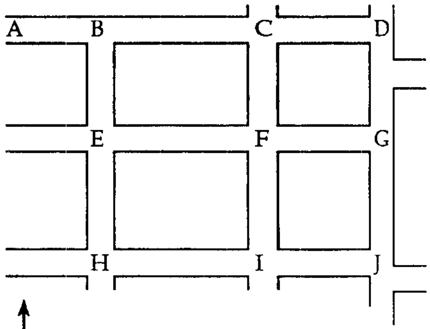
Calculate the perimeter of the triangle. (4)

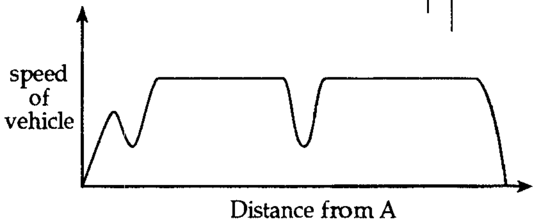
part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1997 Credit**
.	4	1.5.3 0.1				1 3				NR	**Qu. 6**

- •[1] *strategy*: e.g. identify r / a triangle between tangent and radius
- •[2] evidence of using valid strategy: e.g. $d^2 = 16^2 - 8^2$
- •[3] $d = 8\sqrt{3}$ (13.856)
- •[4] Perimeter $= 6d = 48\sqrt{3}$ (83.14)



The top diagram shows part of the street plan of a town.
Vehicles can travel in both directions along each street.
As a vehicle travels on the straight parts of any street it can reach the maximum speed.
The speed is always reduced on the bends.
The graph shows how the speed of a vehicle changes as it travels from **A to J**.





(*a*) What route did the vehicle travel? Use the letters from the top diagram to indicate this route. (2)

(*b*) Another vehicle took the route A, B, C, F, G and J. Sketch a graph to show how the speed of this vehicle changes during the journey. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	0.1					2			NR	**1997 Credit Qu. 7**
(b)	3	0.1					3			NR	

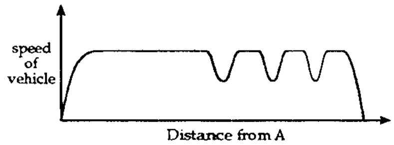
•1 ...B...H...

•2 ABEHIJ

•3 graph shows 3 corners

•4 graph shows 1 long and short stretches

•5 start and finish on distance axis and both axes labelled



(*a*) Factorise **completely** $2x^2 - 6x$. (1)

(*b*) Express $\frac{2x^2 - 6x}{x^2 - 9}$ in its simplest form. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	1.4.2	1							R	**1997 Credit Qu. 8(b)**
(b)	3	1.4.3	2							R	
		3.1.1	1								

•1 $2x(x-3)$

•4 $\frac{2x^2-6x}{(x-3)(x+3)}$

•5 $\frac{2x(x-3)}{(x-3)(x+3)} = \frac{2x}{(x+3)}$

(*a*) Remove the brackets and collect like terms

$$(3a-b)(2a-5b).$$ (2)

(*b*) Solve **algebraically** the equation $2x^2-9x-5=0$. (3)

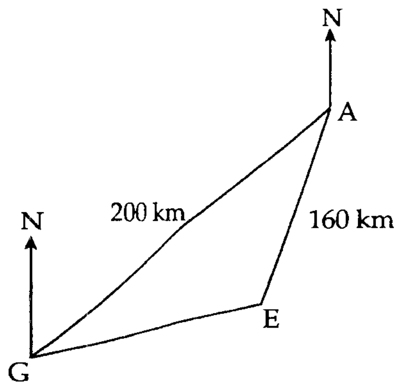
part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1997 Credit Qu. 11**
(a)	2	1.4.1	2							R	
(b)	3	3.2.5	3							R	

- •[1] $6a^2-2ab-15ab+5b^2$
- •[2] $6a^2-17ab+5b^2$
- •[3] $(2x+1)\times\ldots$
- •[4] $\ldots\times(x-5)$
- •[5] $x=-\frac{1}{2}$ and $x=5$

The diagram shows the positions of three airports, A, E and G.

- G is 200 kilometres from A.
- E is 160 kilometres from A.
- From G the bearing of A is 052°.
- From A the bearing of E is 216°.

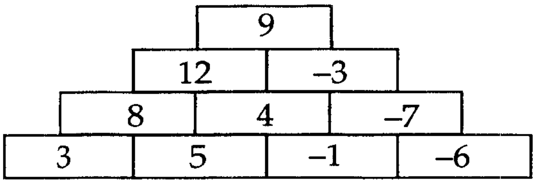
How far apart are airports G and E? (6)



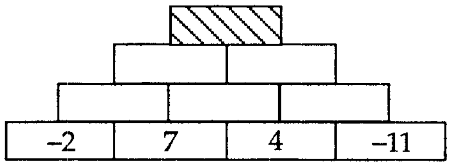
part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1997 Credit Qu. 12**
.	6	2.1.3				3				NR	
		0.1				3					

- •[1] interpreting either bearing
- •[2] *strategy for* $G\hat{A}E$: *e.g.* $G\hat{A}N=128°$
- •[3] $G\hat{A}E=16°$
- •[4] *strategy*: *e.g.* choose cosine rule
- •[5] $GE^2=200^2+160^2-2\times200\times160\cos16°$
- •[6] $GE=63.9$ *km*

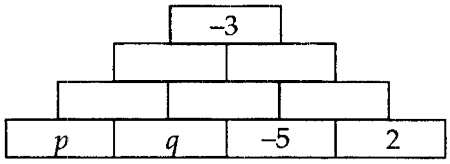
A number tower is built from bricks as shown in this diagram. The number on the brick above is always equal to the sum of the two numbers beneath it.



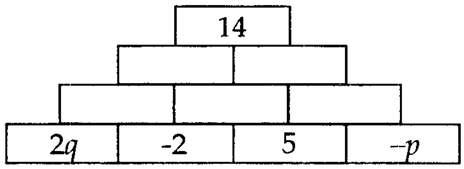
(*a*) Find the number on the shaded brick in this diagram: (1)



(*b*) In this diagram, two of the numbers on the base bricks are represented by p and q. Show that $p + 3q = 10$. (2)



(*c*) Use the third diagram below to write down a second equation in p and q. (2)



(*d*) Find the values of p and q. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1					1			R	**1997 Credit Qu. 14**
(b)	2	0.1						2		NR	
(c)	2	0.1						2		NR	
(d)	3	2.2.3						3		NR	

•1 20

•2 $p+q$ **and** $q-5$ **and** -3

•3 $p+2q-5$ **and** $q-8$ **and** $p+3q-13=-3$ **giving** $p+3q=10$

•4 *strategy*: as for (b) giving $2q-p+9$

•5 $2q-p=5$

•6 *st*: use sim. equations

•7 following strategy thr' to produce values for p & q

•8 $p=1$ **and** $q=3$

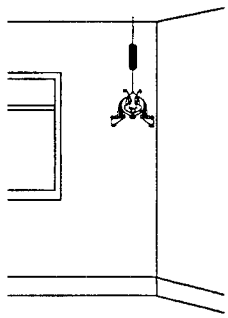
(*a*) Express $\sqrt{72} - \sqrt{2} + \sqrt{50}$ as a surd in its simplest form. (3)

(*b*) Express $\dfrac{3y^5 \times 4y^{-1}}{6y}$ in its simplest form. (3)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1997 Credit Qu. 15**
(a)	3	3.1.4		3						R	
(b)	3	3.1.6		3						R	

- $\bullet^1$ $6\sqrt{2}$
- $\bullet^2$ $5\sqrt{2}$
- $\bullet^3$ $10\sqrt{2}$
- $\bullet^4$ $y^5 \times y^{-1} = y^4$
- $\bullet^5$ $\frac{y^4}{y} = y^3$
- $\bullet^6$ $\frac{12}{6} = 2$

A toy is hanging by a spring from the ceiling.
Once the toy is set moving, the height,
H metres, of the toy above the floor is given by the formula



$$H = 1.9 + 0.3\cos(30t)^\circ$$

t seconds after starting to move.

(*a*) State the maximum value of H. (1)

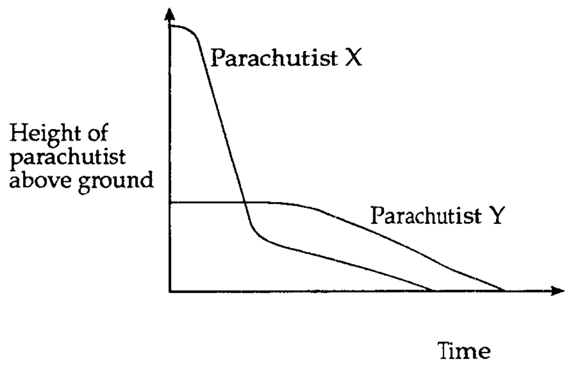
(*b*) Calculate the height of the toy above the floor after 8 seconds. (3)

(*c*) When is the height of the toy **first** 2.05 metres above the floor? (3)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			**1997 Credit Qu. 16**
(a)	1	0.1				1				NR	
(b)	3	0.1				3				NR	
(c)	3	3.3.3				3				NR	

- $\bullet^1$ 2.2
- $\bullet^2$ *strategy*: know to use formula and $t = 8$
- $\bullet^3$ $1.9 + 0.3\cos 240^\circ$
- $\bullet^4$ 1.75
- $\bullet^5$ *strategy*: *e.g.* substitute: $2.05 = 1.9 + 0.3\cos 30t^\circ$
- $\bullet^6$ following strategy thr' to produce a value for t
- $\bullet^7$ $t = 2$

Two parachutists, X and Y, jump from two separate aircrafts at different times.
The graph shows how their height above the ground changes over a period of time.



(*a*) Which parachutist jumped first? (1)

(*b*) Which parachutist did not open his parachute immediately after jumping?
Explain your answer clearly. (2)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
(a)	1	0.1					1			NR	**1998 Credit Qu. 2**
(b)	2	0.1					2			NR	

•[1] X

•[2] X

•[3] graphs shows two rates of fall

A skip is prism shaped as shown in figure 1.

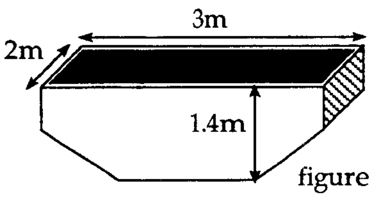


figure 1

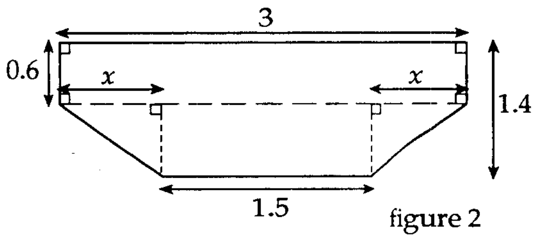


figure 2

The cross-section of the skip, with measurements in metres, is shown in figure 2.

(*a*) Find the value of x. (1)

(*b*) Find the volume of the skip in cubic metres. (3)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
(a)	1	0.1			1					R	**1998 Credit Qu. 3**
(b)	3	1.2.1			3					R	

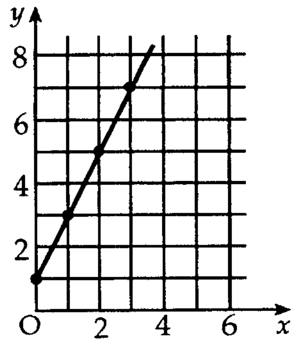
•[1] $x = 0.75$

•[2] area $= 3 \times 0.6 + 1.5 \times 0.8 + 2 \times \frac{1}{2} \times 0.75 \times 0.8 = 3.6$

•[3] use the area answer to produce a value for the volume

•[4] volume $= 3.6 \times 2 = 7.2$

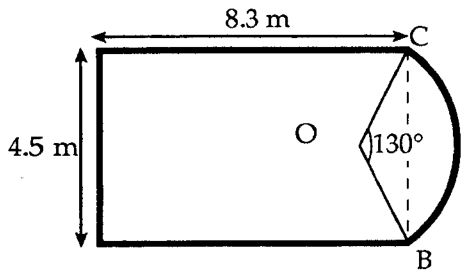
Find the equation of the straight line. (3)



part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	1.3.3	3							R	**1998 Credit Qu. 5**

- •[1] intercept = 1
- •[2] gradient = 2
- •[3] $y = 2x + 1$

The diagram below shows a ceiling in the shape of a rectangle and a segment of a circle.
The rectangle measures 8.3 metres by 4.5 metres.
OB and OC are radii of the circle and angle BOC is 130°.



(*a*) Find the length of OB. (3)

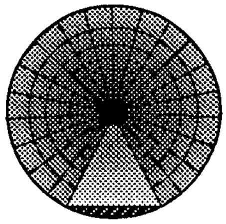
A border has to be fitted round the perimeter of the ceiling.
(*b*) Find the length of border required. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	3	0.1			3					NR	**1998 Credit Qu. 7**
(b)	4	1.5.1				3				NR	
		0.1				1					

- •[1] *strategy*: *e.g.* $\sin 65° = \frac{2.25}{OB}$
- •[2] *follow strategy thr'*: to produce a value for OB
- •[3] $OB = 2.48$
- •[4] *strategy*: $arcBC = \frac{130}{360} \times 3.14 \times 4.96$
- •[5] *follow strategy thr'*: to produce a value for arc BC
- •[6] $arc\ BC = 5.62$
- •[7] $Perimeter = 4.5 + 8.3 + 5.62 + 8.3 = 26.72$

Figure 1 shows the circular cross-section of a tunnel with a horizontal floor.

figure 1



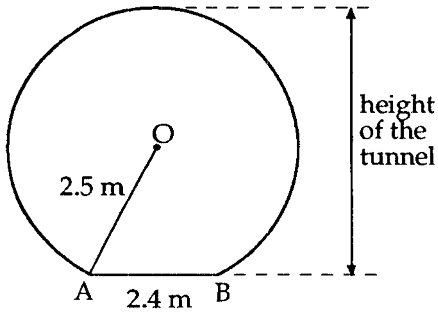


figure 2

In figure 2, AB represents the floor. AB is 2.4 metres.
The radius, OA, of the cross-section is 2.5 metres.

Find the height of the tunnel. (4)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
.	4	1.5.5				4				R	1998 Credit Qu. 8

$\bullet^1$ *method: e.g.* show r / a triangle with base = 1.2, hyp = 2.5

$\bullet^2$ $x^2 = 2.5^2 - 1.2^2$

$\bullet^3$ $x = 2.19$ (ignore rounding to 1dp)

$\bullet^4$ height = 2.19 + 2.5 = 4.69

The cost of taking a school group to the theatre can be calculated from the information shown below.

***1 adult goes free with every 10 pupils ***

Number of pupils	Cost per pupil	Cost per paying adult
less than 10	£5.00	£8.00
10 to 19	£4.50	£7.00
20 to 29	£4.00	£6.00
30 to 39	£3.00	£5.00

(*a*) Find the cost for a group of 12 pupils and 3 adults. (2)

(*b*) Write down a formula to find the cost, £*C*, of taking a group of *p* pupils and *d* adults where $20 \le p \le 29$. (4)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
(a)	2	0.1					2			NR	1998 Credit Qu. 9
(b)	4	2.2.1						4		NR	

$C = 4p + 6(d-2)$

$\bullet^1$ $12 \times$ £4.50

$\bullet^2$ $2 \times$ £7 **and** £68

$\bullet^3$ $d - 2$

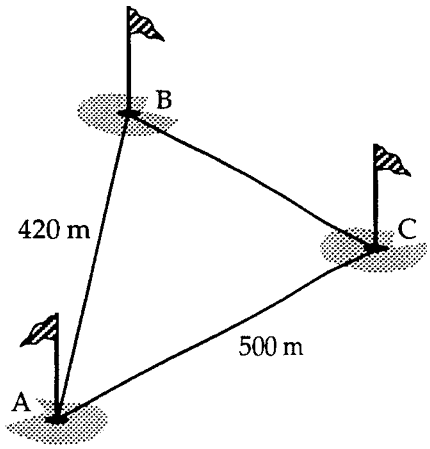
$\bullet^4$ $6(d-2)$

$\bullet^5$ $4p$

$\bullet^6$ $4p$ + "*expression in d*"

The diagram shows part of a golf course.
The distance AB is 420 metres, the distance AC is 500 metres and angle BAC = 52°.

Calculate the distance BC.
Do not use a scale drawing.



(3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	2.1.3			3					R	**1998 Credit Qu. 10**

•[1] *strategy*: *e.g.* using cosine rule
•[2] $BC^2 = 420^2 + 500^2 - 2 \times 420 \times 500 \times \cos 52°$
•[3] $BC = 409.7$ (disregard rounding)

$BC^2 = 176400 + 250000 - 258578$
$BC^2 = 167822$

(*a*) Solve, **algebraically**, the system of equations

$$2a + 4b = -7$$
$$3a - 5b = 17.$$
(3)

(*b*) If $d = \dfrac{k-m}{t}$, change the subject of this formula to k (2)

(*c*) Solve, **algebraically**, the equation $x^2 = 7x$. (3)

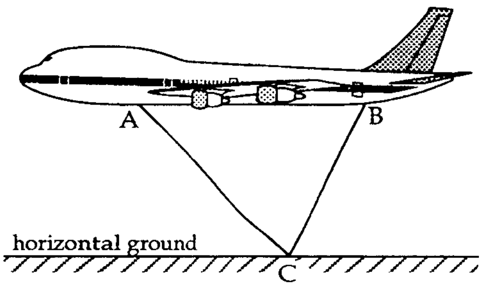
part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	3	2.2.3	3							R	**1998 Credit Qu. 11**
(b)	2	3.1.3		2						R	
(c)	3	3.2.5		3						R	

•[1] *strategy*: correct scaling e.g. $10a + 20b = -35$ **and** $12a - 20b = 68$
•[2] $a = 1\frac{1}{2}$
•[3] $b = -2\frac{1}{2}$

•[4] $dt = k - m$
•[5] $k = dt + m$

•[6] $x^2 - 7x = 0$
•[7] $x(x-7) = 0$
•[8] $x = 0$ **and** $x = 7$

An aeroplane is flying parallel to the ground.
Lights have been fitted at A and B as shown in the diagram.
When the aeroplane is flying at a certain height, the beams from these lights meet exactly on the ground at C.



The distance AB is 20 metres.
The angle of depression of the beam of light from A to C is 50°.
The angle of depression of the beam of light from B to C is 70°.

Find the height of the aeroplane above C. (6)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	6	2.1.3 0.1				4 2				NR	**1998 Credit Qu. 12**

- •[1] interpretation of 50° and 70°
- •[2] $A\hat{C}B = 60°$
- •[3] *strategy*: *e.g.* $\frac{BC}{\sin 50°} = \frac{20}{\sin 60°}$
- •[4] $BC = 17.7$
- •[5] *strategy*: *e.g.* $\frac{h}{17.7} = \sin 70°$
- •[6] $h = 16.6$

A 3×3 square has been identified on the calendar shown in the diagram.
The numbers in the diagonally opposite corners of the square are multiplied. These products are then subtracted in the order shown below.

$$(\mathbf{23} \times \mathbf{11}) - (\mathbf{25} \times \mathbf{9}) = \mathbf{28}$$

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	**9**	10	**11**	12
13	14	15	16	17	18	19
20	21	22	**23**	24	**25**	26
27	28	29	30	31		

(*a*) Repeat the above process for a different 3×3 square. **Show clearly all your working.** (1)

(*b*) Prove that **in every** 3×3 square on the calendar above the process gives the answer 28. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1					1			NR	**1998 Credit Qu. 14**
(b)	3	0.1						3		NR	

- •[1] *e.g.* 7 8 9 / 14 15 16 / 21 22 23; $21 \times 9 - 7 \times 23 = 189 - 161 = 28$
- •[2] *strategy*: introducing a variable
- •[3] $n,\ n+2,\ n+14,\ n+16$
- •[4] $(n+14)(n+2) - n(n+16) = n^2 + 16n + 28 - n^2 - 16n = 28$

Solve, **algebraically**, the equation $7\cos x° - 2 = 0$, for $0 \le x < 360$. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	3.3.4				3				R	**1998 Credit Qu. 15**

- •[1] $\cos x° = \frac{2}{7}$
- •[2] $x = 73.4$
- •[3] $x = 286.6$

Traffic authorities are investigating the number of cars travelling along a busy stretch of road. They assume that all cars are travelling at a speed of v metres per second.
The number of cars, N, which pass a particular point on the road in one minute is given by the formula $N = \frac{30v}{2+v}$.
In one minute, 26 cars pass a point on the road.

Find the speed of the cars in metres per second. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	0.1						3		NR	**1998 Credit Qu. 16**

- •[1] $26 = \frac{30v}{2+v}$
- •[2] $26(2+v) = 30v$
- •[3] $52 = 4v \ldots\ldots v = 13$

(*a*) Factorise $4a^2 - 9b^2$. (2)

(*b*) Express as a single fraction in its simplest form

$$\frac{1}{2x} - \frac{1}{3x}, \quad x \neq 0$$ (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	1.4.4		2						R	**1998 Credit Qu. 17**
(b)	2	3.1.2		2						R	

•1 $(2a-3b)\times\ldots$

•2 $\ldots\times(2a+3b)$

•3 $\frac{\ldots\ldots\ldots}{6x}$

•4 $\frac{1}{6x}$

On a certain day the depth, *D* metres, of water at a fishing port, *t* hours after midnight, is given by the formula

$$D = 12.5 + 9.5\sin(30t)°.$$

(*a*) Find the depth of the water at 1.30 pm. (3)

(*b*) The depth of water in the harbour is recorded each hour. What is the maximum difference in the depths of water in the harbour over the 24 hour period?
Show clearly all your working. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	3	0.1				3				NR	**1998 Credit Qu. 18**
(b)	3	0.1				3				NR	

•1 *method*: know to substitute into formula

•2 $D = 12.5 + 9.5\sin(30\times 13.5)°$

•3 $D = 19.2$

•4 *strategy*: attempt to find max & min depths

•5 *follow thr' strategy*: produce values for max & min

•6 max difference $= 22 - 3 = 19$

(*a*) Multiply out the brackets $\sqrt{2}\left(\sqrt{6}-\sqrt{2}\right)$.

Express your answer as a **surd** in its simplest form. (2)

(*b*) Express $\dfrac{b^{\frac{1}{2}} \times b^{\frac{3}{2}}}{b}$ in its simplest form. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	3.1.4		2						R	**1998 Credit Qu. 19**
(b)	2	3.1.6		2						R	

- •1 $\sqrt{12}-\sqrt{4}$
- •2 $2\sqrt{3}-2$
- •3 $\dfrac{b^2}{b}$
- •4 b

Paul bought a car last year.

It has lost $12\frac{1}{2}\%$ of its value since then. It is now valued at £10 500.

How much did Paul pay for his car? (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	2	1.1.1			2					R	**1999 Credit Qu. 1**

- •[1] $87\frac{1}{2}\%$ of cost = £10500
- •[2] 100% of cost = £10550 × $\frac{100}{87.5}$ = £12000

A newspaper report stated:

"Concorde has now flown $7 \cdot 1 \times 10^7$ miles.
This is equivalent to 300 journeys from the earth to the moon."

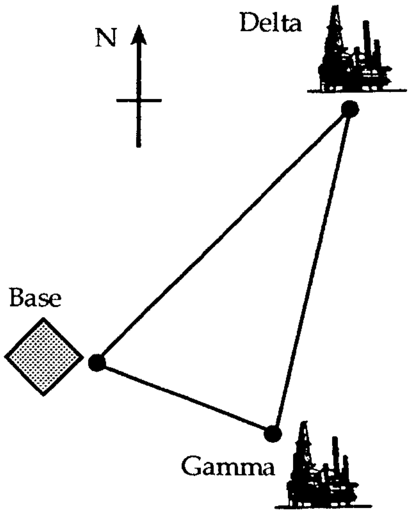
Calculate the distance from the earth to the moon.

Give your answer **in scientific notation correct to 2 significant figures.** (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	0.1 1.2.2			2 1					R	**1999 Credit Qu. 2**

- •[1] $7.1 \times 10^7 \div 300$
- •[2] 2.366×10^5
- •[3] 2.4×10^5

The diagram shows the positions of a helicopter base and two oil rigs, Delta and Gamma.
From the helicopter base, the oil rig Delta is 35 kilometres away on a bearing of 050°.
From the same base, the oil rig Gamma is 20 kilometres away on a bearing of 125°.
Calculate the distance between Delta and Gamma.
Do not use a scale drawing.

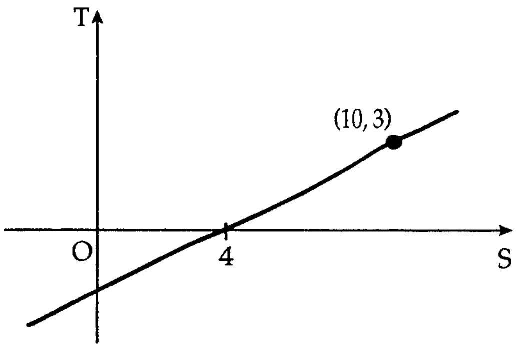


(5)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	5	0.1 2.1.3			2 3					NR	**1999 Credit Qu. 4**

- •[1] correct interpretation of both bearings
- •[2] $D\hat{B}G = 75°$
- •[3] appearance of cosine rule
- •[4] $35^2 + 20^2 - 2 \times 35 \times 20 \times \cos 75°$
- •[5] $35.5km$

Find the equation of the given straight line in terms of T and S. (4)



part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	1.3.3		4						R	**1999 Credit Qu. 5**

- •[1] $m = \frac{1}{2}$
- •[2] $0 = \frac{1}{2} \times 4 + c$
- •[3] $c = -2$
- •[4] $T = \frac{1}{2}S - 2$

Factorise $3x^2 - 5x - 2$. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	2	1.4.4		2						R	**1999 Credit Qu. 6**

•[1] & •[2] **both** factors correct *i.e.* $(3x+1)(x-2)$

Anna hired a mobile phone at a fixed charge of £17·50 per month.

She is also charged for her total call time each month.

15 minutes of this total call time are **free**. The rest of her call time is charged at 35 pence per minute.

(*a*) What is the total cost for Anna's phone in a month when her **total call time** is 42 minutes? (2)

(*b*) Write down a formula for the total cost, £*C*, for Anna's phone in a month when her **total call time** is *t* minutes, where $t \geq 15$. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	0.1	2							R	**1999 Credit Qu. 7**
(b)	3	2.2.1	3							NR	

•[1] $(42-15)\times 0.35$

•[2] $17.50+(42-15)\times 0.35 = £26.95$

•[3] $t-15$

•[4] $\times$ 35

•[5] $C = 17.5 + 0.35(t-15)$

$[C = 12.25 + 0.35t]$

A Fibonacci sequence is a sequence of numbers. After the first two terms, each term is the sum of the previous two terms.

example

2, 3, 5, 8, 13,……

$5 = 2 + 3$ $13 = 5 + 8$

(a) Write down the next three terms of this Fibonacci sequence: 5, –1, 4, , , , **(1)**

(b) For the Fibonacci sequence

4, –3, 1, –2, –1, –3, –4, ………

show that the sum of the first six terms is equal to four times the fifth term. **(2)**

(c) If p and q are the first two terms of a Fibonacci sequence, **prove** that the sum of the first six terms is equal to four times the fifth term. **(3)**

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	0.1					1			NR	**1999 Credit Qu. 8**
(b)	2	0.1					2			NR	
(c)	3	0.1						3		NR	

•[1] 3, 7, 10

•[2] $4 \times -1 = -4$

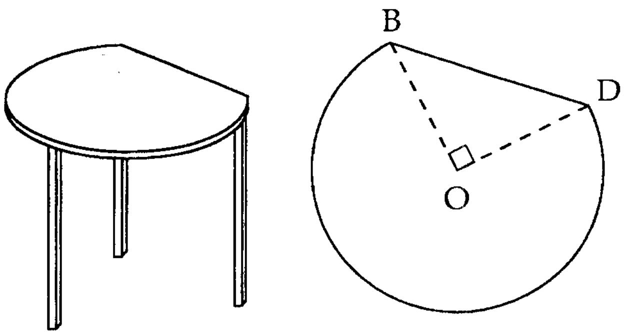
•[3] $4 + (-3) + 1 + (-2) + (-1) + (-3) = -4$

•[4] $p,\ q,\ p+q,\ p+2q,\ 2p+3q,\ 3p+5q$

•[5] sum of these 6 terms $= 8p + 12q$

•[6] $4 \times (2p + 3q) = 8p + 12q$ **and** this equals the sum

The diagram shows a table whose top is in the shape of part of a circle with centre, O, and radius 60 centimetres.



BD is a straight line.
Angle BOD is 90°.
Calculate the perimeter of the table top. **(3)**

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	1.5.1			2					NR	**1999 Credit Qu. 9**
		0.1			1						

•[1] $BD^2 = 60^2 + 60^2$

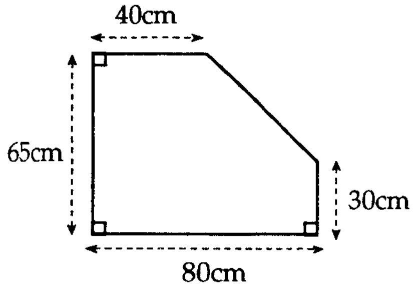
•[2] $\text{arc}BD = \frac{3}{4} \times 2 \times \pi \times 60$

•[3] $P = 84.85 + 282.6 = 367.45$

A wooden toy box is prism-shaped as shown in figure 1.

The uniform cross-section of the box is shown in figure 2.

Figure 2



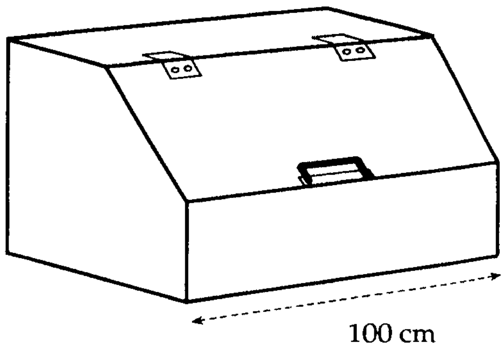


Figure 1

Calculate the volume of the box in cubic metres. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	1.2.1			4					R	**1999 Credit Qu. 10**

- •[1] *strategy*: *e.g.* area of rectangle – area of triangle
- •[2] $80 \times 65 - \frac{1}{2} \times 40 \times 35 = 4500$
- •[3] $V = 450\ 000\text{cm}^3$
- •[4] $V = 0.45\text{m}^3$

Solve algebraically the equation $2 + 3\sin x° = 0$ for $0 \le x \le 360$. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	3	3.3.4				3				R	**1999 Credit Qu. 12**

- •[1] $\sin x° = -\frac{2}{3}$
- •[2] $x = 221.8$
- •[3] $x = 318.2$

The tickets for a Sports Club disco cost £2 for members and £3 for non-members.

(*a*) The total ticket money collected was £580.
x tickets were sold to members and y tickets were sold to non-members.
Use this information to write down an equation involving x and y. (2)

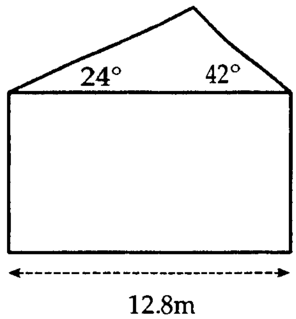
(*b*) 250 people bought tickets for the disco.
Write down another equation involving x and y. (1)

(*c*) How many tickets were sold to members? (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	2.2.1	2							R	1999 Credit Qu. 13
(b)	1	2.2.1	1							R	
(c)	3	2.2.3	3							NR	

- •[1] $2x$ **or** $3y$
- •[2] $2x + 3y = 580$
- •[3] $x + y = 250$
- •[4] *strategy*: *eg* $2x + 2y = 500$
- •[5] $y = 80$ **or** $x = 170$
- •[6] remaining variable (*consistent with* •[5])

The end wall of a bungalow is in the shape of a rectangle and a triangle as shown here.



The roof has one edge inclined at 24° to the horizontal and the other edge inclined at 42° to the horizontal.

The width of the house is 12.8 metres.

Calculate the length of the longer sloping edge of the roof.
Do not use a scale drawing. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
.	4	2.1.3			4					R	1999 Credit Qu. 14

- •[1] 114°
- •[2] *strategy*: *e.g.* choose sine rule
- •[3] $\frac{x}{\sin 42°} = \frac{12.8}{\sin 114°}$
- •[4] $x = 9.38m$

can also be solved using r/a trig.

A gardener creates an L-shaped flower-bed. He uses the house walls and concrete edging for the boundary as shown in figure 1.
He plans his flower-bed as shown in figure 2.

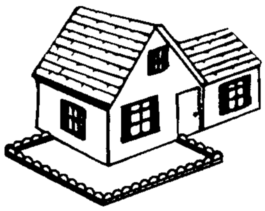
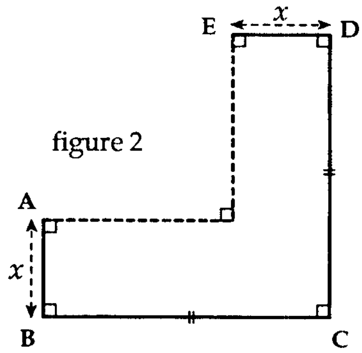


figure 1



(*a*) He uses a total of **6 metres of edging.**
AB = ED = x metres and BC = DC
Show that the length, in metres, of BC can be expressed as BC = $3 - x$. (2)

(*b*) Hence show that the area, A, in square metres, of the flower-bed can be expressed as

$$A = 6x - 3x^2.$$ (3)

(*c*) Calculate **algebraically** the maximum area of the flower-bed. (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	2	0.1						2		NR	**1999 Credit Qu. 15**
(b)	3	0.1						2		NR	
		1.4.1						1			
(c)	3	1.4.2						1		NR	
		3.2.2, 0.1						2			

- •1 $AB + BC = 3$
- •2 $x + BC = 3$ and completes proof
- •3 $x \times BC = x(3-x)$
- •4 $x \times (DC - x) = x(3-2x)$
- •5 $A = 3x - x^2 + 3x - 2x^2$ and completes proof
- •6 *strategy*: find zeroes i.e. $6x - 3x^2 = 0$
- •7 axis of symmetry is $x = 1$
- •8 $A(1) = 3m^2$

(*a*) Express $\sqrt{32}$ as a surd in its simplest form. (1)

(*b*) Simplify $a^2\left(a^{-5} + 4\right)$. (2)

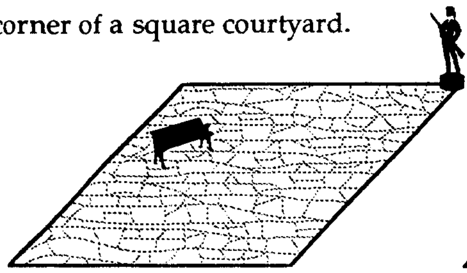
(*c*) Multiply out the brackets and collect like terms

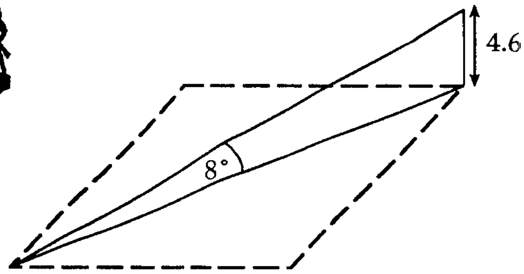
$$(x-2)\left(x^2 + 3x + 4\right).$$ (3)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B		R/NR	Source
(a)	1	3.1.4	1							R	**1999 Credit Qu. 16**
(b)	2	3.1.6		2						R	
(c)	3	1.4.1		3						R	

- •1 $4\sqrt{2}$
- •2 a^{-3}
- •3 $4a^2$
- •4 $x^3 + 3x^2 - 4x$
- •5 $-2x^2 - 6x + 8$
- •6 $x^3 + x^2 - 10x + 8$

A statue stands at the corner of a square courtyard.





The statue is 4.6 metres high.

The angle of elevation from the opposite corner of the courtyard to the top of the statute is 8°.

(*a*) Find the distance from the base of the statue to the opposite corner of the courtyard. (2)

(*b*) Show that the length of the side of the courtyard is approximately 23 metres. (3)

part	marks	Content ref.	non-calc		calc		calc neut			R/NR	Source
			C	A/B	C	A/B	C	A/B			
(a)	2	0.1				2				NR	**1999 Credit Qu. 17**
(b)	3	0.1				3				NR	

•[1] $\tan 8° = \frac{4.6}{d}$

•[2] $d = 32.7$

•[3] *strategy*: *eg* $32.7^2 = L^2 + L^2$

•[4] $L = 23.122$

•[5] $L = 23m$ to nearest metre

Attendances at Taycity football ground over last season, to the nearest 1000, were as follows:

4000 3000 4000 6000 8000 5000 4000 5000 7000

(*a*) List the five values you would use to draw a boxplot of this data. (3)

(*b*) Calculate the semi-interquartile range. (1)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
(a)	3	2.3.3					3		R		**Qu. 1**
(b)	1	2.4.1					1		R		

•[1] 3000 **and** 8000

•[2] 5000

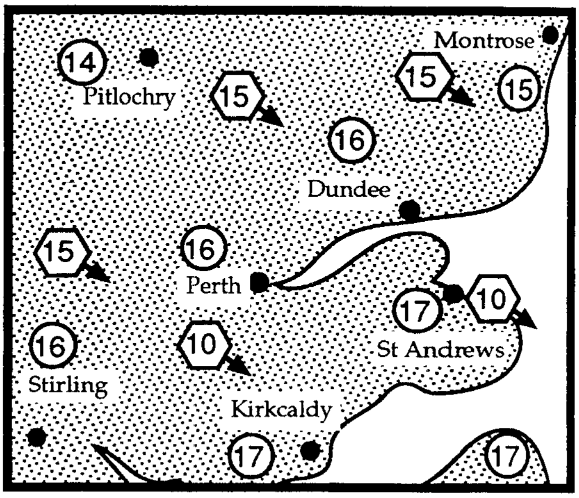
•[3] 4000 **and** 6500

•[4] $SIQR = \frac{6500-4000}{2} = 1250$

The weather map shows a sample of temperatures in °C and wind speeds in m.p.h. for a day in June.

Wind speeds are shown inside hexagons with black arrows attached.
Temperatures are shown inside circles.

Find the standard deviation of these temperatures, showing all your working. (4)



part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
.	4	2.4.2			1	3			R		**Qu. 2**

•[1] $\frac{\Sigma x}{n} = \frac{128}{8} = 16$

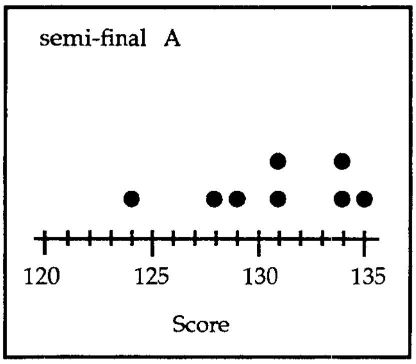
•[2] *e.g.* calculate $(x-\bar{x})^2$ to get $2^2,\ 0^2,\ 1^2,\ 0^2,\ 0^2,\ 1^2,\ 1^2,\ 1^2$ or equiv. (in any order)

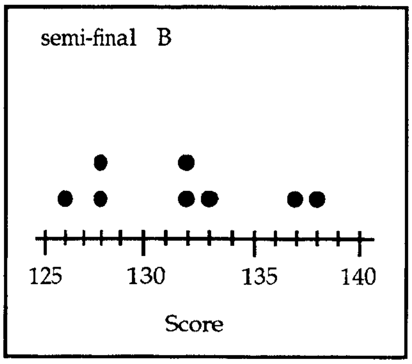
•[3] *e.g.* $s = \sqrt{\frac{(x-\bar{x})^2}{n-1}} = \sqrt{\frac{8}{7}}$

•[4] $s = 1.07$

•[3] *e.g.* $s = \sqrt{\frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]} = \sqrt{\frac{1}{7}\left[2056 - \frac{16384}{8}\right]}$

The following dotplots show the results of two semi-finals of a masterclass competition.





(*a*) The three leaders in each semi-final together with the two next highest scorers go through to the final.
By considering the marks of the three leaders in each semi-final, say how many go through from each semi-final. (2)

(*b*) The results of the final were as follows:

contestant no.	1	2	3	4	5	6	7	8
score	126	130	122	123	134	130	131	123

Show these results on a dotplot. (2)

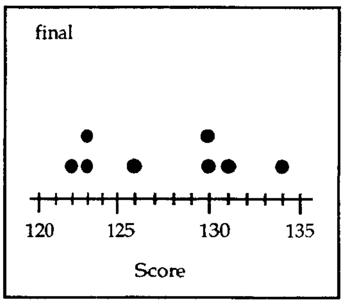
part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
											[redacted]
(a)	2	2.3.3						2	NR		
(b)	2	2.3.3					2		R		**Qu. 3**

•[1] *from A*: 134, 134, 135
or *from B*: 133, 137, 138

•[2] 3 *from A* **and** 5 *from B*

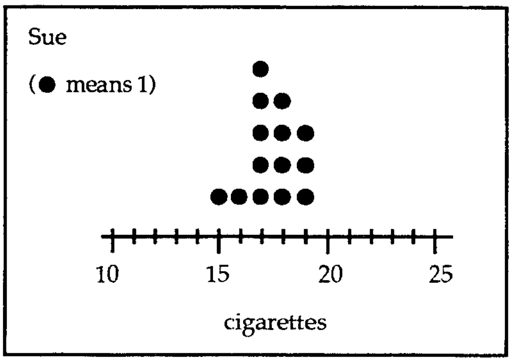
•[3] scale going from at least 122 → 134 **and** labelled "score"

•[4] ≥ 7 dots correctly shown



Two friends, Sue and Kate, each trying to give up smoking, kept a record of the number of cigarettes each smoked per day over a period of a fortnight.

(*a*) Sue's records are shown in the diagram.



Find the median number of cigarettes she smoked. (1)

(*b*) Kate's records are shown below:

13	17	22	22	25	22	16
18	16	14	19	17	14	11

Show them as a dotplot and find the median. (3)

(*c*) Compare these records. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
(a)	1	2.3.3					1		R		
(b)	3	2.3.3					3		R		Qu. 4
(c)	2	2.3.3						2	R		

•1 $7th = 17$, $8th = 18$ so median = 17.5
or *from B*: 133, 137, 138

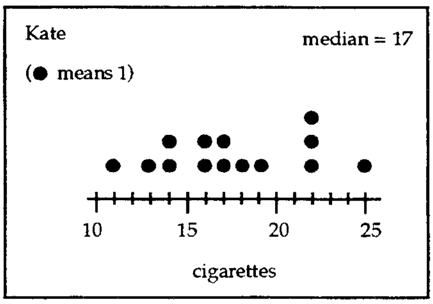
•2 scale going from at least 11 → 25
and labelled "cigarettes"

•3 ≥ 13 dots correctly shown

•4 $7th = 17$, $8th = 17$ so median = 17

•5 medians much the same
or Sue's median slightly higher

•6 Kate's records more spread out (more variation)



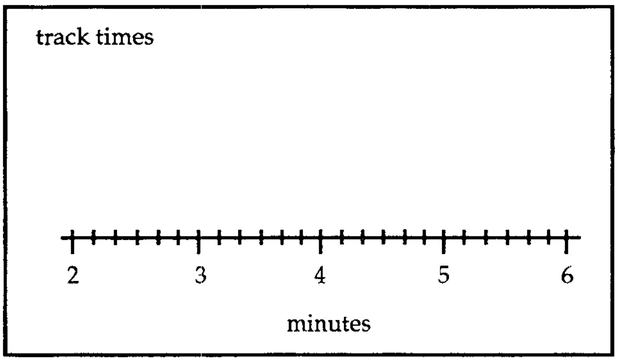
QUEEN : GREATEST HITS

BOHEMIAN RHAPSODY	5:52	2:41	CRAZY LITTLE THING CALLED LOVE
ANOTHER ONE BITES THE DUST	3:23	4:53	SOMEBODY TO LOVE
KILLER QUEEN	2:59	4:12	NOW I'M HERE
FAT BOTTOMED GIRLS	3:21	2:53	GOOD OLD-FASHIONED LOVER BOY
BICYCLE RACE	2:59	3:28	PLAY THE GAME
YOU'RE MY BEST FRIEND	2:49	2:46	FLASH
DON'T STOP ME NOW	3:29	2:47	SEVEN SEAS OF RHYE
SAVE ME	3:51	2:00	WE WILL ROCK YOU
		3:00	WE ARE THE CHAMPIONS

The sleeve of this CD shows the times in minutes and seconds of the various tracks.
An analysis of the times gives the lower quartile as 2:48 and the upper quartile as 3:40.

(*a*) What is the semi-interquartile range? (2)

(*c*) Copy the scale below and construct a boxplot to illustrate the track times. (4)



part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
(a)	2	2.4.1					2		R		[redacted] **Qu. 5**
(b)	4	2.3.3					4		R		

•[1] $\frac{1}{2}(Q_3 - Q_1) = \frac{1}{2}(3{:}40 - 2{:}48)$

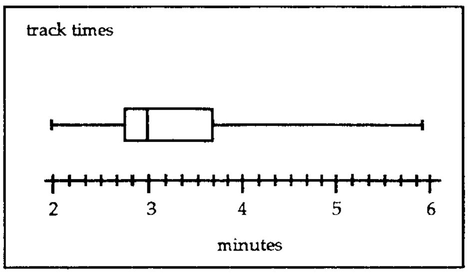
•[2] 26 seconds

•[3] whiskers end at 2 **and** 5:52

•[4] box ends at 2:48 and 3:40

•[5] *strategy*: know to find median (evidence – ordered list or median = 9th score)

•[6] median at 3



No. of days with no sunshine, August 1996

Place	days	Place	days	Place	days
Stornaway	7	Valley	1	Heathrow	0
Aviemore	3	Waddington	0	Rhoose	1
Dyce	5	Lowestoft	2	Hastings	0
Leuchars	0	Elmdon	0	Hurn	0
Abbotsinch	2	Cambridge	3	St Mawgan	4
Eskdalemuir	2	Aberporth	1	Aldergrove	3
Durham	1	Lyneham	1	Casement	3
Ringway	0				

(*a*) Copy and complete the frequency table to display the information on 'no sunshine' days given. (2)

number of days with no sunshine	frequency

(*b*) This frequency table gives the number of days with no rainfall in the same month.
Construct a cumulative frequency column.
Find the median and semi-interquartile range. (4)

number of days with no rainfall	frequency
12	1
13	0
14	1
15	4
16	2
17	4
18	3
19	3
20	2
21	2

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
(a)	2	0.1					2		R		Qu. 6
(b)	4	2.3.1					1		R		
		2.4.1					3				

- •[1] variable goes from 0 to 7
- •[2] frequencies are 7, 5, 3, 4, 1, 1, 0, 1
- •[3] cfs are 1, 1, 2, 6, 8, 12, 15, 18, 20, 22
- •[4] median = 17
- •[5] $Q_1 = 15$ **and** $Q_3 = 19$
- •[6] SIQR $= \frac{1}{2}(19-15) = 2$

US Open Golf Championship 1999 : Second round scores

total score	frequency
137	3
138	0
139	4
140	2
141	4
142	6
143	9
144	9
145	8
146	13
147	10

Find the five scores required to construct the boxplot of this data and calculate the semi-interquartile range. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
.	4	2.3.3 2.4.1						3 1	R		Qu. 7

- •[1] 137 **and** 147
- •[2] median = 144
- •[3] $Q_1 = 142$ **and** $Q_3 = 146$
- •[4] $\text{SIQR} = \frac{1}{2}(146 - 144) = 2$

Munros in The Cullins on the Island of Skye

name	*height, h(m)*
Sgurr nan Gillean	965
Am Basteir	935
Bruach na Frithe	958
Sgurr na Banachdich	965
Sgurr a'Mhadaidh	918
Sgurr a'Greadaidh	972
Sgurr Dearg & The Inaccessible Pinnacle	986
Sgurr Alasdair	993
Sgurr Mhic Choinnich	948
Sgurr Dubh Mor	944
Sgurr nan Eag	924
Bla Bheinn	928

The above table gives the heights of all the Munros in the Cullins on the Island of Skye.

Find the standard deviation of these heights showing all your working clearly. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
.	4	2.4.2			1	3			R		[redacted] Qu. 8

•[1] $\frac{\Sigma h}{n} = \frac{11436}{12} = 953$

•[2] *e.g.* calculate $(h-\bar{h})^2$ to get 12^2, $(-18)^2$, 5^2, 12^2, $(-35)^2$, 19^2, 33^2, 40^2, $(-5)^2$, $(-9)^2$, $(-29)^2$, $(-25)^2$ or equiv.

•[3] *e.g.* $s = \sqrt{\frac{(x-\bar{x})^2}{n-1}} = \sqrt{\frac{6484}{11}}$

•[4] $s = 24.28$

•[3] *e.g.* $s = \sqrt{\frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]} = \sqrt{\frac{1}{11}\left[10904992 - \frac{11436 \times 11436}{12}\right]}$

Here are the ten biggest blockbusters of all time, based on their North American box office gross takings. Dollar amounts are not adjusted for inflation.

Title	US Release Date	US Gross Takings, t ($ millions)
Titanic	19/12/97	515
Star Wars	25/5/97	460
Independence Day	3/7/96	306
Forrest Gump	6/7/94	329
The Lion King	15/6/94	312
Jurassic Park	11/6/93	356
Home Alone	16/11/90	284
Return of the Jedi	25/5/83	309
E.T,: The Extra Terrestrial	11/6/82	399
The Empire Strikes Back	21/5/80	290

Find the standard deviation, showing all your working. (4)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
.	4	2.4.2			1	3			R		Qu. 9

•[1] $\frac{\Sigma t}{n} = \frac{3560}{10} = 365$

•[2] *e.g.* calculate $(t-\bar{t})^2$ to get 159^2, 104^2, $(-50)^2$, $(-27)^2$, $(-44)^2$, 0^2, $(-72)^2$, $(-47)^2$, 43^2, $(-66)^2$, or equiv.

•[3] *e.g.* $s = \sqrt{\frac{(x-\bar{x})^2}{n-1}} = \sqrt{\frac{54860}{9}}$

•[4] $s = 78.07$ million

•[3] *e.g.* $s = \sqrt{\frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]} = \sqrt{\frac{1}{11}\left[1322220 - \frac{3560 \times 3560}{10}\right]}$

Everyone knows that 'Titanic' is the biggest box office hit of all time.
But if box office takings are adjusted for inflation, the following list gives the takings of the top ten movies.

Title	US Release Date	US Adjusted Gross Takings ($millions)
Snow White and The Seven Dwarfs	1937	476
Gone With the Wind	1939	863
The Ten Commandments	1956	572
Doctor Zhivago	1965	542
The Sound of Music	1965	571
The Jungle Book	1967	485
Jaws	1975	560
Star Wars	1977	775
E.T.	1982	594
Titanic	1997	515

Draw a boxplot to illustrate the adjusted takings for these movies. Show all your working. (5)

part	marks	Content ref.	non-calc		calc		calc neut		R/NR		Source
			C	A/B	C	A/B	C	A/B			—
.	5	2.3.3						5	R		Qu.10

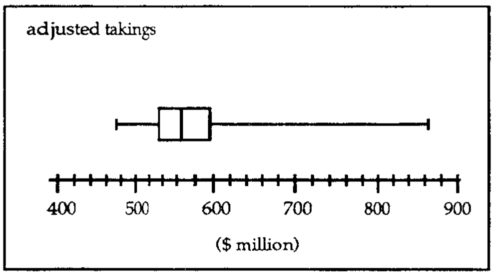
•1 476, 485, 515, 542, 560, 571, 572, 594, 775, 863

•2 median = 565.5

•3 $Q_1 = 515$ **and** $Q_2 = 594$

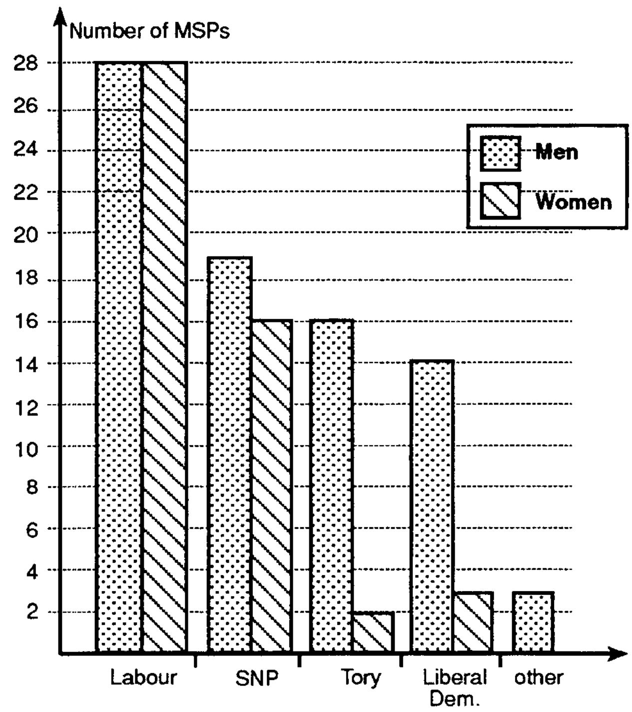
•4 axes run from at least 476 to 863 with any label

•5 box and whiskers shown correctly



The diagram shows the make up of the Scottish Parliament which was elected in May 1999.

The Labour Party failed to get an overall majority (more MSPs than the other parties put together).
How many MSPs were they short of an overall majority?



(3)

part	marks	Content ref.	non-calc		calc		calc neut		R/NR		Source
			C	A/B	C	A/B	C	A/B			[redacted]
.	3	0.1					3		NR		Qu.11

•[1] total MSPs $= 28+28+19+16+16+2+14+3+3 = 129$

•[2] to have an overall majority they must have $\frac{1}{2}$ *of* $(129+1) = 65$

•[3] shortfall $= 65 - 28 - 28 = 9$

In one week Ronnie rents out 90 items from his shop, as shown in the table below.

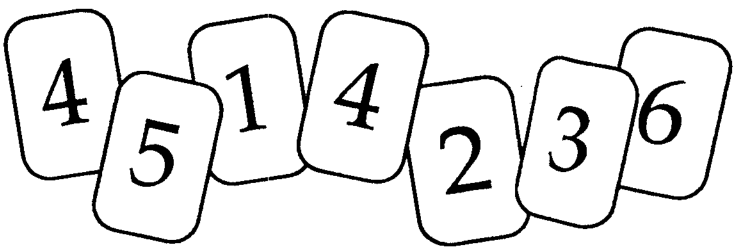
Item	Frequency
Televisions	35
Videos	30
Computers	17
Other equipment	8

Draw a pie chart to ilustrate the frequency of rentals. (4)

part	marks	Content ref.	non-calc		calc		calc neut		R/NR		Source
			C	A/B	C	A/B	C	A/B			
.	4	2.3.4			2	2			R		Qu. 12

- •[1] *e.g.* $\frac{35}{90}\times 360$ **or** 1 item $= 4°$
- •[2] **any 3 calculations** of 140°, 120°, 68°, 32°
- •[3] drawing
- •[4] appropriate labelling

Brenda has 7 cards. The cards are numbered as shown.



Brenda chooses one card at random.
What is the probability of her getting an even number? (2)

part	marks	Content ref.	non-calc		calc		calc neut		R/NR		Source
			C	A/B	C	A/B	C	A/B			
.	2	2.4.5					2		R		Qu. 13

- •[1] $\frac{\dots}{6}$
- •[2] $\frac{4}{\dots}$

In a survey of some families, the number of children in each was recorded. The results are summarised in the following table.

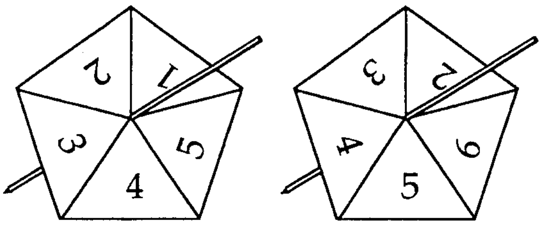
Number of children	0	1	2	3	4
Number of families	5	20	16	8	1

Calculate the probability that a family, chosen at random, has one child. (2)

part	marks	Content ref.	non-calc		calc		calc neut		R/NR		Source
			C	A/B	C	A/B	C	A/B			
.	2	2.4.5			2				R		**Qu.14**

•1 $\frac{\dots}{50}$

•2 $\frac{20}{\dots}$



Two fair spinners are used for a game. The scores from each spinner are added together.
The table shows all the possible totals for the two spinners.

	1	2	3	4	5
2	3	4	5	6	7
3	4	5	6	7	8
4	5	6	7	8	9
5	6	7	8	9	10
6	7	8	9	10	11

What is the probability of scoring a total of more than 9? (2)

part	marks	Content ref.	non-calc		calc		calc neut		R/NR		Source
			C	A/B	C	A/B	C	A/B			
.	2	2.4.5	2						NR		**Qu.15**

•1 $\frac{\dots}{25}$

•2 $\frac{3}{\dots}$

The following prices (in pence) of a litre of unleaded petrol were noted at nine petrol stations selected at random in a Scottish city on 26th April 1999.

71.7 74.3 74.8 74.2 77.2 71.7 75.2 74.2 77.2

Calculate the standard deviation of the prices, giving your answer correct to two decimal places. (4)

part	marks	Content ref.	non-calc		calc		calc neut		R/NR		Source
			C	A/B	C	A/B	C	A/B			
.	4	2.4.2			4				R		**Qu.16**

- •[1] $\frac{\Sigma x}{n} = \frac{670.5}{9} = 74.5$
- •[2] calculate *e.g.* $(x-\bar{x})^2$ to get 2.8^2, $(-0.2)^2$, 0.3^2, $(-0.3)^2$, 2.7^2, $(-2.8)^2$, 0.7^2, $(-0.3)^2$, 2.7^2 *or equiv.*
- •[3] *e.g.* $\sqrt{\frac{(x-\bar{x})^2}{n-1}} = \sqrt{\frac{31.06}{8}}$
- •[4] 1.97

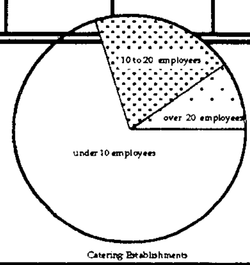
A survey of employment in the catering industry revealed that

10% of the establishments had over 20 employees
20% of the establishments had between 10 and 20 employees
The rest has less than 10 employees.

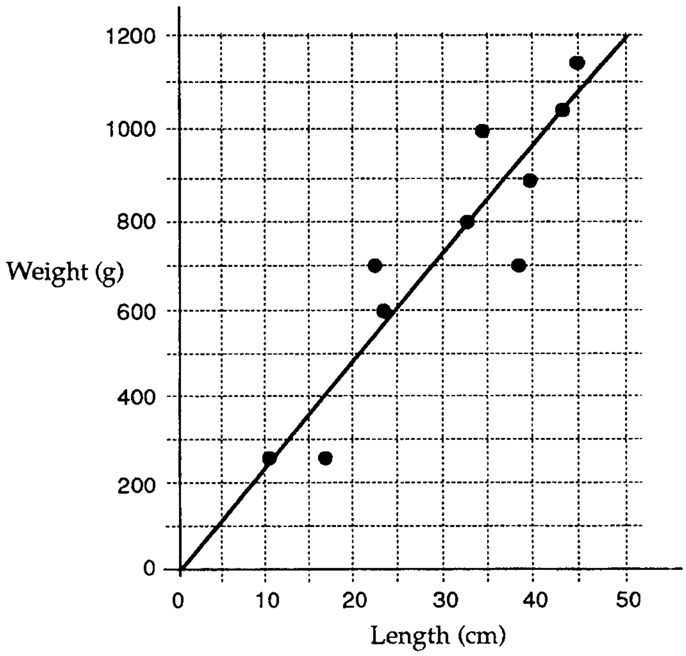
Draw a pie chart to illustrate this information. (3)

part	marks	Content ref.	non-calc		calc		calc neut		R/NR		Source
			C	A/B	C	A/B	C	A/B			
.	3	2.3.4						3	R		**Qu.17**

- •[1] **any 2 calculations** of 36°, 72°, 252°
- •[2] drawing
- •[3] appropriate labelling



A research team visits a remote island. As part of a conservation exercise the weight and length of each of ten birds of one particular species are taken. The results are shown on the scattergraph and the best fitting straight line has been drawn.



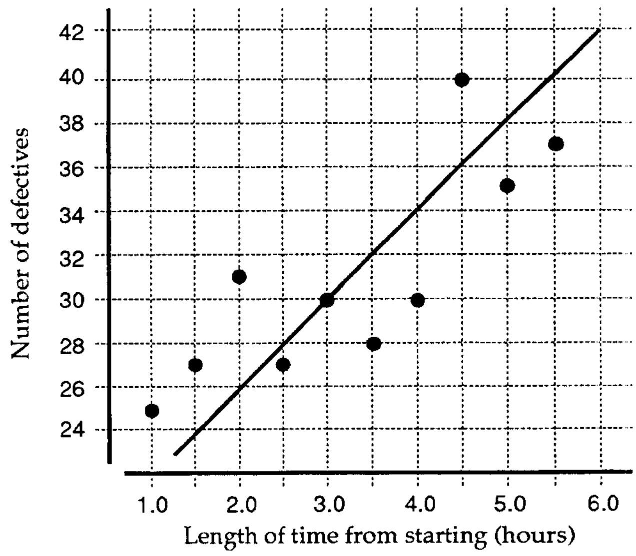
(*a*) Determine the equation of this line. (4)

(*b*) Use the equation of this line to estimate the weight of a bird of length 30 cm. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
(a)	4	2.4.3			4				R		**Qu.18**
(b)	2	2.4.3			2				R		

$\bullet^1$	*strategy*: use 2 points (s / i by $\bullet^2$)	$\bullet^3$	$c = 0$	$\bullet^5$	24×30
$\bullet^2$	$m = 24$	$\bullet^4$	$y = 24x$	$\bullet^6$	720 g

A production manager suspects that the number of defective items produced in a 15-minute period increases with the number of hours a workman has been working. A survey was taken of the number of defective items in each of ten 15-minute periods. The results are shown on the scattergraph and the best fitting straight line has been drawn.



(*a*) Determine the equation of this line. (4)

(*b*) Use the equation of this line to forecast the number of defectives expected when the workmen have been working for 7 hours from starting. (2)

part	marks	Content ref.	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	R/NR		Source
(a)	4	2.4.3					4		R		**Qu.19**
(b)	2	2.4.3					2		R		

$\bullet^1$	*strategy*: use 2 points (s / i by $\bullet^2$)	$\bullet^3$	$y = 4x + c$	$\bullet^5$	$4 \times 7 + 18$
$\bullet^2$	$m = 4$	$\bullet^4$	$y = 4x + 18$	$\bullet^6$	46 (defectives)