GCSE

Mark Scheme

Mathematics A （1387）

June 2003

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NOTES ON MARKING PRINCIPLES

NOTES ON MARKING PRINCIPLES

1   Three types of mark are available
M marks - awarded for correct working seen or implied.
A marks - conditional accuracy marks which are awarded for accurate working following the award of M marks.
B marks - unconditional accuracy marks (independent of M).

2   Abbreviations
cao - correct answer only.
ft - follow through.
$\sqrt{}$ -   Denotes a "follow through" answer.

SC - special case.
isw - ignore subsequent working.
oe - or equivalent (and appropriate).
NB: a candidate cannot benefit from both isw and ft.

3   If no working shown, then
correct answers normally score full marks
incorrect (even though nearly correct) answers score no marks.

4   Marking instructions
Misread loses A marks (and sometimes B marks) on that part but ft can be allowed on subsequent parts. M marks can still be earned. If in doubt contact your team leader.
If there is a wrong answer in the answer space DO CHECK the working in the body of the script.
- If it is clear from working that the "correct" answer has been obtained from incorrect working, award no marks. If in doubt contact your team leader.
- If there is a wrong answer in the answer space DO CHECK the working in the body of the script.
- If it is clear from working that the "correct" answer has been obtained from incorrect working, award no marks. If in doubt contact your team leader.

5   Style of marking
Answer correct: tick and write part mark in margin NEXT TO BRACKETED MARK.
Answer incorrect: cross, but show M, A or B marks if any earned in body of script and transfer the total of these to the margin next to the bracket mark.
Total for each double page at bottom right page (except for back if used), FINAL TOTAL IN RELEVANT BOX ON FRONT COVER.
Nought in margin for fully incorrect question or page AND FOR NO ATTEMPT.
Where no attempt has been made a line should be put in the answer space and zero in the margin next to the bracketed mark
CHOICE OF METHOD – No marks unless one answer is in answer space – then mark that.
CROSSED OUT WORK - if not replaced this should be marked (if legible).
There must always be a mark next to bracketed mark in the margin/

6 Follow Through Marks

Follow throughs are guided by two principles:

 (a) Follow throughs which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous, do not award.
 (b) Follow throughs which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

7 Probability

Probability answers must be given as fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least two decimal places (unless tenths).
Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.
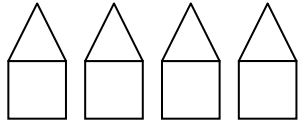
8 Linear Equations
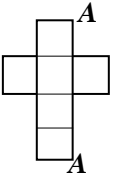
Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

9 Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

Paper 5501

No		Working	Answer	Mark	Notes
1	(a)		46	1	B1 cao
	(b)		3.4	1	B1 oe
	(c)		Arrow at 430	1	B1 allow ± half graduation
	(d)		Arrow at 3.7	1	B1 allow ± half graduation Accept indications other than arrows as long as they are clear
2			1.60 2.05	2	B1) Condone B1) reversal
3	(a)	$\frac{18}{24}$ or $\frac{9}{12}$ or $\frac{6}{8}$	$\frac{3}{4}$	2	B2 for $\frac{3}{4}$ cao (B1 for $\frac{18}{24}$ or $\frac{9}{12}$ or $\frac{6}{8}$) SC B1 for $\frac{1}{4}$ only
	(b)		16 squares shaded	1	B1 cao
4	(a)		line	1	B1 within overlay tolerance
	(b)		midpoint	1	B1 within overlay tolerance ft from (a) ± 0.2cm
	(c)		rectangle	1	B1 for rectangle 6 cm ± 0.2cm by 4 cm ± 0.2cm
5			kilograms, kg	3	B1
			litre, l or cubic metres, m^3		B1
			inches, in		B1
6	(a)		parallel lines marked	1	B1
	(b)		right angle marked	1	B1
	(c)(i)		acute	1	B1
	(ii)		reflex	1	B1
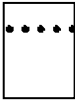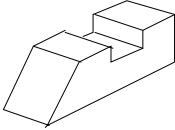
Paper 5501

No		Working	Answer	Mark	Notes
7	(i)		sphere	1	B1
	(ii)		cylinder	1	B1 Accept circular prism
	(iii)		pyramid	1	B1 Condone omission of "triangular" Accept tetrahedron
8	(a)(i)		40	2	B1 cao
	(ii)		50		B1 cao
	(b)		5 complete symbols	1	B1 cao
	(c)		and oe inc	1	B1
9	(i)		9, 37, 56, 59, 75	5	B1 cao
	(ii)		0.067, 0.56, 0.6, 0.605, 0.65		B1 cao Ignore trailing zeros
	(iii)		−10, −6, −4, 2, 5		B1 cao
	(iv)		$\dfrac{2}{5}, \dfrac{1}{2}, \dfrac{2}{3}, \dfrac{3}{4}$		B2 for all 4 correct (B1 for any 3 in correct order) SC B1 for all 4 in reverse order (applies to(iv) only)
10	(a)			1	B1
	(b)		Plotting (4, 24)	1	B1 ft from their matchsticks
	(c)		60	1	B1 cao
	(d)		$m = 6n$	2	B2 for $m = 6n$ oe (B1 for 6n oe or m = multiple of n except $m = n$)
11	(i)		6, 12	4	B1 cao
	(ii)		4, 16		B1 cao
	(iii)		3, 4, 6 or 3, 4, 6, 12		B1 Condone omission of 12
	(iv)		8, 27		B1 cao

Paper 5501

No	Working	Answer	Mark	Notes
12		2.43	4	B1 for 36 or 0.36 B1 for 96 or 0.96 B1 for 125 or 1.25 If none of first 3 B1s awarded then SC B1 for four 24s and five 25s seen OR 4 × 24 and 5 × 25 seen B1 for 2.43 cao
13 (a)(i) (ii) (b)		Edinburgh and Plymouth 12 Cardiff and Belfast London and Plymouth	3 2	B1 for Edinburgh or −7 B1 for Plymouth or 5 B1ft from (i) if one positive and one negative B1 for Cardiff and Belfast OR −6 and −4 B1 for London and Plymouth OR 3 and 5
14		5 9 8	3	B1 cao B1 cao B1 cao
15 (a)			2	✓ × 2 0 B2 1 0 B1 1 1 B1 2 1 B1
(b)	$2 \times 2 \times 2$	8	2	M1 for $2 \times 2 \times 2$ A1 for 8 cao
16 (a) (b) (c)	 $2 \times 29 = 58$ $5 \times 30 = 150$ $2 \times 31 = 62$ $1 \times 32 = 32$ $\dfrac{302}{10} = 30.2$	30 3 30.2	1 1 3	B1 cao B1 cao M1 for freq × no pins M1 (dep on 1st M1) for totalling and ÷ 10 A1 for 30.2 cao

Paper 5501

No	Working	Answer	Mark	Notes
17		$\begin{array}{ccc} & & 7 \\ & 5 & \\ 5 & 13 & 33 \\ 52 & 23 & \end{array}$	3	B3 all correct (B2 for 4, 5 or 6 correct B1 for 2 or 3 correct)
18 (a)(i) (ii) (iii) (iv) (b)		$4c$ p^4 $8g$ $10pr$ OR $10rp$ $10y - 15$	4 1	B1 oe B1 cao B1 oe B1 B1 cao Accept $10y + -15$
19		$\dfrac{2}{3}$	3	M1 for 3 rows (9 squares) shaded M1 for 2 columns (10 squares) shaded A1 for $\dfrac{2}{3}$
	$\dfrac{3}{5} = \dfrac{9}{15}$ $\dfrac{2}{3} = \dfrac{10}{15}$	$\dfrac{2}{3}$	3	M1 for $\dfrac{3}{5} = \dfrac{9}{15}$ M1 for $\dfrac{2}{3} = \dfrac{10}{15}$ A1 for $\dfrac{2}{3}$
	$\dfrac{3}{5} = 0.6$ $\dfrac{2}{3} = 0.66$ or 0.67 or better	$\dfrac{2}{3}$	3	M1 for $\dfrac{3}{5} = 0.6$) Accept) M1 for $\dfrac{2}{3} = 0.66$ or 0.67 or better) percentages A1 for $\dfrac{2}{3}$

Paper 5501

No		Working	Answer	Mark	Notes

20	(a)	955 48
		   48 OR 955
		 7640 240
		 38200 2400
		 45840 43200
		            45840
			458.40	3	M1 for complete correct method (condone one computational error)
					 A2 for 458.40 cao
					 (A1 for digits 4584 OR ft if M1 awarded)

	(b)	14. 5 48 $\mid$ 696. 0 48 216 192 24 0 24 0	14.50	3	M1 for 1 as first digit in answer and remainder 21 M1 (dep) 4 as second digit in answer A1 for 14.50 (Accept 14.5)
21	(a)		$12x$	1	B1 oe
	(b)		$12x + 10y$	2	B2 oe ft from (a) (B1 $12x$ + multiple of y or $10y$ seen) SC B1 for $x = 12x + 10y$ OR $y = 12x + 10y$

No		Working	Answer	Mark	Notes
22		$\dfrac{1}{3}+\dfrac{1}{4}=\dfrac{4}{12}+\dfrac{3}{12}=\dfrac{7}{12}$ $1-\dfrac{7}{12}=\dfrac{5}{12}$	$\dfrac{5}{12}$	3	M1 for $\dfrac{4}{12}$ **and** $\dfrac{3}{12}$ oe A2 for $\dfrac{5}{12}$ oe (A1 for $\dfrac{7}{12}$) B1 for $1-"\left(\dfrac{1}{3}+\dfrac{1}{4}\right)"$ correctly evaluated
		$1-\dfrac{1}{3}=\dfrac{2}{3}$, $1-\dfrac{1}{4}=\dfrac{3}{4}$ $\dfrac{8}{12}-\dfrac{3}{12}=\dfrac{5}{12}$ or $\dfrac{9}{12}-\dfrac{4}{12}=\dfrac{5}{12}$	$\dfrac{5}{12}$	3	B1 for $\dfrac{2}{3}$ or $\dfrac{3}{4}$ seen M1 for $\dfrac{8}{12}-\dfrac{3}{12}=\dfrac{5}{12}$ or $\dfrac{9}{12}-\dfrac{4}{12}=\dfrac{5}{12}$ A1 for $\dfrac{5}{12}$ oe
			$\dfrac{5}{12}$	3	M1 for 0.25 and 0.33 or better A1 for 0.58 or better A1 for $0.41\dot{6}$ or recurring
23	(a)		54	1	B1 cao
	(b)(i)	$180 - (54 + 54)$	72	3	M1 for $180 - (54 + 54)$ A1 ft from (a) if $x < 90$
	(ii)		Reason		B1 for mentioning isosceles and equal or base angles or equal sides and equal or base angles

No	Working	Answer	Mark	Notes
24 (a)		Bryani	2	M1 for 4×9 or $4 \times 3 \times 3$ or $4 \times x \times x$ or square x first or square 3 first A1 SC 4×3^2 with Bryani scores B2
(b)		64	1	B1 cao
25 (a)		dotted line may be solid	3	B2 for rectangle base 3 squares and height 4 squares (B1 for rectangle with one correct dimension) B1 for horizontal line 1 cm from top) SC B2 for completely correct elevation on its side
(b)			2	B2 for perspective drawing showing slant face and cutout B1 for perspective drawing with either slant face cutout omitted
26 (a)	20×2 or $\dfrac{20}{30} \times 60$ or $20 \div \dfrac{1}{2}$	40	2	M1 for 20×2 or $\dfrac{20}{30} \times 60$ or $20 \div \dfrac{1}{2}$ A1 cao
(b)	$\dfrac{20}{60}$ or $\dfrac{1}{3}$ or 20 minutes	line from (45, 20) to (65, 0)	2	M1 for $\dfrac{20}{60}$ or $\dfrac{1}{3}$ or 20 minutes seen A1 for correct line SC If M0, B1 for line from (45, 20) to (t, 0) where $t > 45$ or B1 for a line of the correct gradient.

Paper 5502

No		Working	Answer	Mark	Notes
1	(a)		$\dfrac{7}{100}$	1	B1 cao accept 0.07
	(b)		0.18	1	B1 cao
	(c)	20 in 100 oe	40	2	M1 for sight of 20 in 100 or 20×2 A1 cao
2	(a)		6cm	2	B1 for 6 ± 0.2 or 60 ± 2 B1 indep for cm or mm consistent with 1st B1
	(b)		At centre	1	B1 within overlay
	(c)		Circle drawn	1	B1 all within overlay
3			See diagram	3	B3 all correct – see separate sheet (B2 for 3 correct B1 for 2 correct)
4	(a)		$\dfrac{1}{4}$ oe	1	B1 cao
	(b)		0.75	1	B1 cao
	(c)		75%	1	B1 cao
	(d)(i)		9	2	B1 accept answer in range 9 - 9.2
	(ii)		15 - 16		B1 accept answers in range 15 - 16
5	(a)		9:30	1	B1 cao
	(b)		2hrs 45 min	2	B2 for 2hr 45 min or $2\dfrac{3}{4}$ hr or 165 minutes B1 2:45 or 2.45 or 165 or 45min + 1hr + 1hr oe
	(c)		17	1	B1 cao
6	(a)	96×4	3.84	2	M1 for 96×4 or digits 384 A1 cao
	(b)	$3 \times 96 + 40 = 328$	(0).56	2	M1 for $3 \times 96 + 40$ or digits 328 or digits 56 A1 cao accept 56p

No		Working	Answer	Mark	Notes
Paper 5502					
7	(a)		54 000	1	B1 cao accept 54 thousand
	(b)		50 000	1	B1 (accept ten thousand or 10 000) oe
8	(a)		14	1	B1 cao
	(b)		6	1	B1 cao
	(c)		Correct reflection	2	B2 fully correct
					(B1 correct reflection in a line parallel to the mirror line or condoning 1 block error in shape or position of shape)
9	(a)		Missing horiz label 1 (and 6) missing on vertical scale	2	B1 B1
	(b)		Correct graph	2	B1 for bar up to 4 for yellow B1 for bar up to 2 for green
	(c)		Blue	1	B1 cao
	(d)	$3 + 5 + 4 + 2$	14	1	B1 ft from (b)
	(e)		$\dfrac{3}{14}$	1	B1 ft on '14'
10		Barry (8) because you double Kath (7) because you add, 1,2,3		2	B1 oe B1 oe SC: B1 for correct rules only
11	(a)		$2n$	1	B1 for $2n$ or $n + n$ OR $2 \times n$ OR $n \times 2$ OR $n2$
	(b)		$2n + 15$	1	B1 for "$2n$" + 15 oe
	(c)		$20q$	1	B1 cao
12	(a)	$1 + 3 + 5 + 8 + 5$	22	2	M1 add frequencies A1 cao
	(b)		No, is>no of cups of coffee in the table	1	B1 'average cannot be bigger than 6' oe OR 'Average must be less than 6 oe'
13	(a)		Trapezium	1	B1 cao ignore spelling
	(b)		(2, 3)	1	B1 cao
	(c)		Isosceles	1	B1 cao ignore spelling
	(d)		Q correct	1	B1 cao

Paper 5502

No		Working	Answer	Mark	Notes
14	(a)		250 000	1	B1 cao
	(b)	$\dfrac{28}{4}$	7	2	M1 for $\dfrac{28}{4}$ oe or "250000" × 28 A1 cao **SC** B1 for 7 000 000
15	(a)		10	1	B1 cao
	(b)		5.5	1	B1 ±0.3 pounds
	(c)	$\dfrac{110}{22}$	50	3	M1 for use of graph at 11 or $\dfrac{110}{22}$ A1 for 5 A1 cao **SC** B2 for 49.5 – 50.6

Paper 5502

No		Working	Answer	Mark	Notes
16	(a)	$269.30 - 56.80 = 212.50$ $\dfrac{212.50}{42.50}$	6	2	M1 for $\dfrac{269.30 - 56.80}{42.50}$ or 5 seen A1 cao
	(b)	5% of £269.30 £269.30 – "£13.465" OR $\dfrac{95}{100} \times 269.30$	255.83 or 255.84	3	M1 for $(5 \div 100) \times 269.30$ M1 for $269.30 - $ "13.465" A1 cao OR M2 for $\dfrac{95}{100} \times 269.30$ A1 cao **Alternative Method:** M1 for $\dfrac{5}{100} \times 56.80$ (= 2.84) and $\dfrac{5}{100} \times 42.50$ (=2.12(5)) (OR 53.96 AND 40.38 (40.375) seen M1 for $56.80 - $ "2.84" (= 53.96) $42.50 - $ "2.12(5)" (= 40.375 or 40.38) "5" × "40.375" + "53.96" A1 cao
17		$4.1^2 \times 1.07 = 16.81 \times 1.07$	17.9867	2	M1 for ("4.1") followed by squaring, or sight of 16.81 A1 cao SC: *B1 for 18 or better with no working*
18	(a)		60	1	B1 cao
	(b)	$360 - 60 - 90 - 90$	120	2	M1 for $360 - $ " 60 " $- 90 - 90$ or $180 - $ "60" A1 cao
	(c)	6×2	12	2	M1 for 6×2 A1 cao for 12

Paper 5502

No		Working	Answer	Mark	Notes
19	(a)(i)	$240 \times 5 = 1200$	1250	3	B1 cao 1250
	(ii)	$\dfrac{50}{'1250'}$	$\dfrac{1}{25}$		M1 cao $\dfrac{50}{'1250'}$ A1 for $\dfrac{1}{25}$ in its simplest form
	(b)	$\dfrac{60}{100} \times 1000 = 600$	12:5	3	M1 for $\dfrac{60}{100} \times 1000$ oe A1 for 600 A1 cao
20	(a)		$x + 2$	1	B1 accept $2 + x$ but not $x = x + 2$
	(b)	$x + 5 + x + 5 + x + 2 + x + 2$	$4x + 14$	2	M1 adding 4 sides, two of which are '$x + 2$' (all sides to be linear expressions in x) **SC** $x + 5 + x + 2 \times 2$ gets M1 A1 for correct simplified answer or $(20 - 14) \div 4$ oe gets M1
	(c)	'$4x + 14$' $= 20$	1.5 oe	2	M1 for equation A1 cao
21		$\Sigma f = 90$	Angles drawn, labelled	3	M1 for 1 person = 4° or one angle correct in table or pie chart A1 any 2 correctly drawn angles in pie chart A1 fully correct chart labelled
22	(a)		$2p - q$	2	B1 cao for $2p$ B1 cao for $-q$ accept $(-q + 2p)$, $2p - 1q$ and $2p + - q$
	(b)	$5x = 3 + 4$	1.4	2	M1 for either (+3 or sight of 7) or ($\div 5$ or sight of 0.8 and 0.6) A1 cao accept $\dfrac{7}{5}$ or $1\dfrac{2}{5}$

Paper 5502

No		Working	Answer	Mark	Notes
23	(a)		$\dfrac{4 \times 5}{2}$	1	B1 cao
	(b)	$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8$	$\dfrac{8 \times 9}{2}$	1	B1 cao
	(c)	$\dfrac{100 \times 101}{2}$	5050	1	B1 cao
24		0 │ 5 7 8 8 1 │ 0 0 0 0 2 5 5 5 6 2 │ 0 0 0 4 5 3 │ 3 5 Key 1 │ 2 = 12 (min)	See working	3	B1 for stem 0, 1, 2, 3 or 0, 10, 20, 30 B1 for accurate unordered leaves condone 1 error or omission B1 for key and ordered leaves all correct
25		$3.2 \times 2.8 = 8.96$ $2 \times 4.5 \times 2.8 = 25.2$ $2 \times 4.5 \times 28.8 = 28.8$ $\dfrac{62.96}{2.5} \times 2.99$	£75.30	5	M1 for area of any face found correctly M1 for 2 areas found correctly A1 for 62.96 or 54 M1 for $\dfrac{'62.96'}{2.5} \times 2.99$ Al cao Alternate method for candidates who round up $\dfrac{"62.92"}{2.5}$ M1 for "26" $\times 2.99$ A1 for £77.74 cao **SC**: *for top included B2 for 71.92 m² seen or* B3 for £86.02 seen **SC** B4 for £64.58 or £65.78 seen
26		$2.5 \times 10\,000$	25 000	2	M1 for $2.5 \times 100 \times 100$ A1 cao
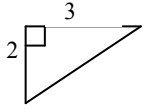
Paper 5503

No	Working	Answer	Mark	Notes
1 (a)(i)		$8g$	2	B1 oe
(ii)		$10rp$		B1 for $10pr$ or $10\ rp$
(b)		$10y - 15$	1	B1 cao accept $10y$ - + 15
(c)	$6x + 8 - 12x + 15$	$-6x + 23$	2	M1 for 3 correct terms out of 4 A1 cao
2		$m = 6n$	2	B2 for $m = 6n$ oe accept $6 \times n$, $n\ 6$ (B1 for $6n$ alone, or $6n + 1$ oe OR m = multiple of n except $m = n$)
3 (i)		0.067, 0.56, 0.6, 0.605, 0.65	1	B1 cao Ignore trailing zeros
(ii)		$-10, -6, -4, 2, 5$	1	B1 cao
(iii)		$\dfrac{2}{5}, \dfrac{1}{2}, \dfrac{2}{3}, \dfrac{3}{4}$	2	B2 all four correct (B1 any three in correct order) SC: B1 all 4 in reverse order
4		7 5 5 13 33 52 23	3	B3 all correct (B2 for 4, 5 or 6 correct entries) (B1 for 2, 3 correct entries)

No	Working	Answer	Mark	Notes
5		$\dfrac{2}{3}$	3	M1 for 3 rows (9 squares) shaded M1 for 2 columns (10 squares) shaded A1
	OR $\dfrac{3}{5} = \dfrac{9}{15}$ $\dfrac{2}{3} = \dfrac{10}{15}$ Therefore $\dfrac{2}{3} > \dfrac{3}{5}$	$\dfrac{2}{3}$		M1 for $\dfrac{3}{5} = \dfrac{9}{15}$ M1 for $\dfrac{2}{3} = \dfrac{10}{15}$ A1
	OR $\dfrac{3}{5} = 0.6$ or percent $\dfrac{2}{3} = 0.66$ or 0.67 or better Therefore $\dfrac{2}{3} > \dfrac{3}{5}$	$\dfrac{2}{3}$		M1 for $\dfrac{3}{5} = 0.6$ or percent M1 for $\dfrac{2}{3} = 0.66$ or 0.67 or better A1
6	$2 \times 29 = 58$ $5 \times 30 = 150$ $2 \times 31 = 62$ $1 \times 32 = 32$ $\dfrac{302}{10} = 30.2$	30.2	3	M1 for freq × no. pins (at least 3) M1 for totalling and for ÷ 10 (dep on 1st M1) A1 cao
7 (a) (b)			2 3	B1 for 180° rotation (wrong centre) B1 cao B1 for any enlargement sf other than 1 B1 for all sides halved B1 for position

Paper 5503

Paper 5503

No		Working	Answer	Mark	Notes
8	(a)		$12x$	1	B1 oe
	(b)		$12x + 10y$	2	B2 oe or ft from (a) (B1 for $12x$ + a multiple of y or $10y$ seen) **SC** B1 for $x = 12x + 10y$ or $y = 12x + 10y$
9		$\dfrac{1}{3}+\dfrac{1}{4}=\dfrac{4}{12}+\dfrac{3}{12}=\dfrac{7}{12}$ $1-\dfrac{7}{12}=\dfrac{5}{12}$ OR $1-\dfrac{1}{3}=\dfrac{2}{3},\ 1-\dfrac{1}{4}=\dfrac{3}{4}$ $\dfrac{9}{12}-\dfrac{4}{12}=\dfrac{5}{12},\ \dfrac{8}{12}-\dfrac{3}{12}=\dfrac{5}{12}$	$\dfrac{5}{12}$	3	M1 for $\dfrac{4}{12}$ and $\dfrac{3}{12}$ oe A2 for $\dfrac{5}{12}$ oe (A1 for getting $\dfrac{7}{12}$) (B1 for $1 - \dfrac{"1"}{3} + \dfrac{1"}{4}$ correctly evaluated) OR B1 for $\dfrac{2}{3}$ or $\dfrac{3}{4}$ seen M1 for $\dfrac{3}{4}-\dfrac{1}{3}=\dfrac{9}{12}-\dfrac{4}{12}$ or $\dfrac{2}{3}-\dfrac{1}{4}=\dfrac{8}{12}-\dfrac{3}{12}$ A1 for $\dfrac{5}{12}$ oe OR M1 0.25 and 0.33 or better A1 for 0.58 or better A1 for 0.416 *recurring*
10	(a)		54	1	B1 cao
	(b)(i)	$180 - (54 + 54)$	72	3	M1 for $180 - ("54" + "54")$ A1 for 72° ft from (a) if $x < 90°$
	(ii)				B1 for mentioning isosceles and equal or base angles or equal sides and equal or base angles

Paper 5503

No		Working	Answer	Mark	Notes
11	(a)	Bryani was correct $4 \times 3^2 = 4 \times 9 = 36$	Bryani	2	M1 for 4×9 or $4 \times 3 \times 3$ or "square the three/x then multiply by four" A1 Bryani **SC** 4×3^2 with Bryani gets B2
	(b)			1	B1 cao
12	(a)			3	B2 for rectangle height 4 squares, base 3 squares (B1 for rectangle with one correct dimension) B1 for line 1 square from the top **SC** B2 for completely correct elevation on its side
	(b)			2	B2 for perspective drawing showing slant face and cut out (B1 for perspective drawing with either slant face or cut out omitted or one aspect incorrect)
13	(a)	20×2 or $\dfrac{20}{30} \times 60$ or $20 \div \dfrac{1}{2}$	40	2	M1 for 20×2 or $\dfrac{20}{30} \times 60$ or $20 \div \dfrac{1}{2}$ A1 cao
	(b)	$\dfrac{20}{60}$ or $\dfrac{1}{3}$ or 20 minutes seen	Line from (45, 20) to (65, 0)	2	M1 for $\dfrac{20}{60}$ or $\dfrac{1}{3}$ or 20 minutes seen A1 for correct line **SC** If M0, B1 for line from (45, 20) to (t, 0) where $t > 45$ or a line of the correct gradient
14	(i)		119.31	3	B1 cao
	(ii)		119 310		B1 cao
	(iii)		1.23		B1 cao

Paper 5503

No		Working	Answer	Mark	Notes
15		$\dfrac{10}{100}\times 12000$ $12\,000 - 1200 = 10\,800$ $\dfrac{10800}{10}=1080$ $10\,800 - 1080 = £9720$	£9720	3	M1 for $\dfrac{10}{100}\times 12000$ or sight of 1200 or 2400 or 10 800 or 9600 M1 (dep) for $\dfrac{10}{100}\times(12\,000 - \dfrac{10}{100}\times 12000)$ or sight of 1080 A1 cao Alternative mark scheme M2 for $12000\times(1-\dfrac{10}{100})^2$ (M1 for $12000\times(1-\dfrac{10}{100})$) A1 cao
16	(a)	$2p = 6$	$p = 3$	2	M1 for $7p - 5p = 8 - 2$ or $2p$ or 6 A1 cao
	(b)	$7r - 5r = -20 - 2$	-11	2	M1 for $7r + 2 = 5r - 20$ or $\dfrac{7r}{5} + \dfrac{2}{5} = r - 4$ or $7r - 5r = 20 - 2$ or $\dfrac{7r}{5} - r = -4 - \dfrac{2}{5}$ A1 cao
17			$5n + 1$	2	B2 oe (B1 for $5n$ seen) NB: $n =$ gets B1 max

Paper 5503

No		Working	Answer	Mark	Notes
18	(a)	−1, 0, 1		2	B2 for −1, 0, 1
					(B1 for −1, 0 or 0,1 or −1,1 or −2, -1, 0, 1 only)
	(b)	(−1, −1), (0, −1), (1, −1), (0, 0),		3	B3 for 6 points correct
		(1, 0), (1, 1)			B2 for 3 points correct
					B1 for 1 point correct
					NB −B1 each additional point over six
19	(a)	Triangle with vertices at (0,0) (0,−2) and (3,0)		2	M1 for correct orientation
					A1 cao
	(b)	Rotation, 180°, centre (0,1)		2	B2 for 180° 'rotation' centre (0, 1)
		Enlargement sf - 1 centre (0,1)			B2 for Enlargement sf - 1 centre (0,1)
					(B1 for any two of the three parts)
					NB: B0 if additional transformation is included
20		Bisector of ∠*BAC*		3	B3 cao
		Arc around *A*			(B2 for <u>either</u> two correct boundaries, no shading/ wrong
		Region			shading <u>or</u> one correct boundary, one incorrect boundary
					with valid shading)
					(B1 for <u>either</u> two incorrect boundaries but one drawn
					from *A* and one intersection, with valid shading <u>or</u> one
					correct boundary)
					Ignore shading outside the triangle
21			Length	3	B1 for Length
			Volume		B1 for Volume
			Area		B1 for Area
22	(a)	Unbiased question with choices		2	B1 for unbiased question
					B1 for at least 2 choices
	(b)			2	Classification 1: A biased question
					Classification 2: A restricted sample of people
					Classification 3: Not specifying a range of foods
					Classification 4: Nothing to do with eating habits
					B2 reasons which satisfy 2 different classifications
					(B1 a reason which satisfies one classification)

Paper 5503

No		Working	Answer	Mark	Notes
23	(a)	$6 \times 10^2 \times 8 \times 10^4$ 48×10^6	4.8×10^7	3	M1 for $6 \times 10^a \times 8 \times 10^b$ oe, a and b integers including 0 A1 for 48×10^6 oe A1 cao
	(b)	$200\ 000 + 30\ 000$	230000	2	B2 cao (B1 for sight of 200 000 or 30 000 or 2.3×10^5 or 23×10^4)
24	(i)		64	4	B1 cao
	(ii)		3		B1 cao
	(iii)	$\sqrt{16 \times 9} = \sqrt{144}$	12		B2 cao (B1 for sight of $\sqrt{2^4} \times \sqrt{9}$ or better, or 144 seen)
25	(i)	Tangent 90° to diameter /radius/ line from (through) centre	27°	4	B1 for 27° cao B1 for reason
	(ii)	 $180 - (90 + \text{"27"})$ angle in semicircle (is 90°)/Alternate segments /angle at centre twice at circumference	63°		B1 ft for 90−"27" if not 63° B1 for reason
26	(a)(i)		152	2	B1 cao
	(ii)		177		B1 cao
	(b)			3	B1 for median marked at 167 B1 ft for postion of box with its ends at "152" and "177" B1 for position of whiskers with ends at 132 and 182 NB: For any points plotted between 141 and 149 give a tolerance of an extra ± 1 square
27		$x^2 + xy + xy + y^2$	$x^2 + 2xy + y^2$	2	M1 for at least 3 of the 4 terms correct A1 cao
			25	2	M1 for recognising 3.47 + 1.53 (= 5) A1 cao

Paper 5504

No		Working	Answer	Mark	Notes
1	(a)	$4.1^2 \times 1.07 = 16.81 \times 1.07$	17.9867	2	M1 for (4.1) followed by squaring, or sight of 16.81
					A1 cao
					SC: B1 for 18 or better with no working
	(b)		$(1.6 + 3.8 \times 2.4)$ $\times 4.2$	1	B1 cao
					Allow additional brackets if they give an expression with value 45.024
2	(a)	$269.30 - 56.80 = 212.50$	6	2	M1 for $\dfrac{269.30 - 56.80}{42.50}$ or 5 seen
					A1 cao
	(b)	5% of £269.30	255.83 or 255.84	3	M1 for $(5 \div 100) \times 269.30$
		£269.30 – "£13.465"			M1 (dep) for $269.30 -$ "13.465"
					A1 cao
		OR $\dfrac{95}{100} \times 269.30$			OR M2 for $\dfrac{95}{100} \times 269.30$
					A1 cao
					Alternative Method:
					M1 for $\dfrac{5}{100} \times 56.80$ $(= 2.84)$
					and $\dfrac{5}{100} \times 42.50$ $(=2.12(5))$
					(OR 53.96 AND 40.38 (40.375) seen
					M1 for $56.80 -$ "2.84" $(= 53.96)$
					$42.50 -$ "2.12(5)" $(= 40.375$ or $40.38)$
					"5" $\times$ "40.375" $+$ "53.96"
					A1 cao

Paper 5504

No		Working	Answer	Mark	Notes
3	(a)		60	1	B1 cao
	(b)	360 – 60 – 90 – 90	120	2	M1 for 360 – "60" – 90 – 90 or 180 – "60" A1 cao
	(c)	6 × 2	12	2	M1 for 6 × 2 A1 cao 12
	(d)		Correct drawing	2	B2 for triangle and construction lines (see overlay) (B1 for 1 line of length 4cm and correct arcs crossing OR for correct triangle with either no arcs or incorrect arcs) SC: B1 similar triangle drawn with construction lines
4	a(i)	240 × 5 = 1200	1250	3	B1 cao 1250
	(ii)	$\dfrac{50}{1250}$	$\dfrac{1}{25}$		M1 $\dfrac{50}{"1250"}$ A1 oe in its simplest form
	(b)	$\dfrac{60}{100} \times 1000 = 600$ 600: 250	12:5	3	M1 for $\dfrac{60}{100} \times 1000$ oe A1 for 600 A1 cao
5	(a)		$x + 2$	1	B1
	(b)	$x + 5 + x + 5 + x + 2 + x + 2$	$4x + 14$	2	M1 adding 4 sides, two of which must be '$x + 2$' (all sides to be linear expressions in x) A1 for correct simplified answer
	(c)	"$4x + 14$" = 20	1.5	2	M1 for equation "$4x + 14$" = 20 OR $\dfrac{20 - 14}{4}$ oe A1 cao

Paper 5504

No		Working	Answer	Mark	Notes
6	(a)		$2p - q$	2	B1 cao for $2p$ B1 cao for $-q$ accept $-q + 2p$ and $2p - 1q$
	(b)	$5x = 3 + 4$	1.4	2	M1 for either (+3 or sight of 7) or (÷ 5 or sight of 0.8 and 0.6) A1 cao accept $\dfrac{7}{5}$ or $1\dfrac{2}{5}$
7	(a)		$\dfrac{4 \times 5}{2}$	1	B1 cao
	(b)	$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8$	$\dfrac{8 \times 9}{2}$	1	B1 cao
	(c)	$\dfrac{100 \times 101}{2}$	5050	1	B1 cao
	(d)		$\dfrac{n(n+1)}{2}$	2	B2 cao (B1 for any quadratic in n)
8		$3.2 \times 2.8 = 8.96$ $2 \times 4.5 \times 2.8 = 25.2$ $2 \times 4.5 \times 3.2 = 28.8$ $\dfrac{62.96}{2.5} \times 2.99$	75.30	5	M1 for area of any face found correctly M1 for 2 areas seen A1 for 62.96 or 54 M1 for $\dfrac{'62.96'}{2.5} \times 2.99$ A1 cao Alternate method for candidates who round up $\dfrac{"62.96"}{2.5}$ M1 for "26" x 2.99 A1 for £77.74 cao SC: for top included B2 for 71.92 m² seen or B3 for £86.02 or £86.71 SC: B4 for £64.58 or £65.78 seen

Paper 5504

No		Working	Answer	Mark	Notes
9		2.5×10000	25000	2	M1 for 2.5×10000 or $2.5 \times 100 \times 100$ A1 cao
10	(a)	$\sum f = 90$ (88), 144, 32, 96	Angles drawn, labelled	3	M1 for 1 person = 4°or one angle correct in table or pie chart A1 any 2 angles correctly drawn in pie chart A1 fully correct chart labelled
	(b)	$0.38 + 0.27 + 0.15$	0.20	2	M1 $1 -$ sum A1 cao
11		0 $\mid$ 5 7 8 8 1 $\mid$ 0 0 0 0 2 5 5 5 6 2 $\mid$ 0 0 0 4 5 3 $\mid$ 3 5 Key 1 $\mid$ 3 = 13 (min)	See working column	3	B1 for stem 0, 1, 2, 3 or 0, 10, 20, 30 B1 for accurate unordered leaves condone 1 error or omission B1 for key and ordered leaves all correct
12	(a)	$V = \pi \times 4^2 \times 10$	$502 - 503$	2	M1 for $\pi \times 4^2 \times 10$ A1 $502 - 503$
	(b)	$P^2 = 10^2 + 8^2$ $P = \sqrt{164}$	$\sqrt{164} < 13$	3	M1 for sight of a correct right-angled triangle M1 for $10^2 + 8^2$ A1 for conclusion based on a correct calculation or 12.8 seen
13	(a)	2×30 2×48	$2 \times 2 \times 3 \times 5$ $2^5 \times 3$	4	M1 for systematic method, eg division, factor trees (at least one prime) A1 cao M1 for systematic method, eg division, factor trees (at least one prime) A1 cao
	(b)		12	1	B1 cao
	(c)	$2^5 \times 3 \times 5$	480	2	B2 cao B1 for $2^5 \times 3 \times 5$ or any correct common multiple

Paper 5504

No		Working	Answer	Mark	Notes
14	(a)		$150 < C \le 200$	2	M1 use of cum freq to find the cost of the 20th or 20.5[th] car OR $\frac{1}{2}\Sigma f$ or $\frac{1}{2}(\Sigma f + 1)$ A1 eg 150 to 200
	(b)		No, because the 21st value is in the same interval	1	B1 20.5[th] or 21st in same interval or an alternative correct explanation
	(c)	$80\% = 5200$ $\frac{5200}{80} \times 100$	6500	3	M1 for $(100 - 20)\% = 5200$ M1 for $\frac{5200}{"80"} \times 100$ A1 cao
15	(a)	$x^2(x + 1) = 230$	AG	2	M1 for $x \times x \times (x +1)$ or $x \times x \times x + 1$ oe A1 cao from $x \times x \times (x +1)$
	(b)	'5 – 150 5.1 – 158.7 5.2 – 167.6 5.3 – 177.0 5.4 – 186.6 5.5 – 196.6 5.6 – 207.0 5.7 – 217.7 5.8 – 228.8 5.9 –240.2 5.85 – 234.4	5.8	4	B 2 for trial between 5.8 and 5.9 inclusive (B1 for different trial between 5 and 6 inclusive) B1 for different trial between 5.8 and 5.85 (not including 5.8) B1 (dep on at least one previous B1) cao for 5.8, 5.81, 5.811

Paper 5504

No		Working	Answer	Mark	Notes
16		$\pi \times \left(\dfrac{15}{2}\right)^2 = 176.715$	88.4cm^2	3	M1 for $\pi \times \left(\dfrac{15}{2}\right)^2$ A1 88.3 − 88.4 B1(ind) for cm²
17	(a)	$5 = 0.5x + 1$	8	2	M1 for $5 = 0.5x + 1$ A1 cao
	(b)		$y = \dfrac{1}{2}x + c$	1	B1 $y = \dfrac{1}{2}x + c$, $c \neq 1$, oe
	(c)		$x = 2y − 2$ OR $x = 2(y − 1)$	2	M1 for correctly multiplying both sides by 2 or correctly isolating $\dfrac{x}{2}$ A1 for $x = 2(y − 1)$, $x = \dfrac{y-1}{0.5}$, $x = \dfrac{y-1}{\frac{1}{2}}$ oe SC: B1 for $x = 2y - 1$
18		$4x − 6y = 22$ $15x + 6y = 54$ $19x = 76$	$x = 4,\ y = -1$	4	M1 for coefficients of x or y the same followed by correct operation, one arithmetical error A1 cao M1(dep on previous M mark) for sub for other variable A1 cao Trial and improvement −0 unless both x and y correct values found

Paper 5504

	No	Working	Answer	Mark	Notes
19	(a)	$SF = \dfrac{10}{6}$ $\dfrac{10}{6} \times 4.8 = 8$	8	2	M1 for sight of $\dfrac{10}{6}$ or $\dfrac{6}{10}$ or 1.67 or better or $\dfrac{CD}{10} = \dfrac{4.8}{6}$ A1 cao
	(b)	$\dfrac{10}{6} \times 4.5 - 4.5 = 3$	19.8	2	M1 for use of SF from (a) to find BC or AC and adding 4 sides A1 cao
20		$\dfrac{6 \times 10^{15}}{3.2 \times 10^{8}}$ 1.875×10^{7}	4.3×10^{3}	3	B3 for 4.3×10^{3} to 4.34×10^{3} (B2 for 1.875×10^{7} oe or 4300 to 4340 or final answer of 1.9×10^{7}) (B1 for sight of 6×10^{15} oe or 3.2×10^{8} oe)
21		$8.5 \times \tan 38 = 8.5 \times 0.7813$	6.64	3	M1 for correct use of trig, eg $\tan 38 = \dfrac{opp}{8.5}$ M1 for $8.5 \times \tan 38$ A1 $6.64 - 6.641$

No		Working	Answer	Mark	Notes
22	(a)		No, as you would expect about 100. Yes, as it is possible to get 200 sixes with a fair dice	1	B1 for a consistent answer
	(b)	$\frac{1}{6}, \frac{5}{6}$ + labels		3	B1 for $\frac{5}{6}$ on the red dice, *not six* branch B1 for a fully complete tree diagram with all branches labelled B1 for $\frac{1}{6}$, $\frac{5}{6}$ on all remaining branches as appropriate

Paper 5505

| No	Working	Answer	Mark	Notes
1 (i) (ii) (iii)		119.31 119310 1.23	3	B1 cao B1 cao B1 cao
2	$\dfrac{10}{100} \times 12000 = 1200$ 12 000 − 1200 = 10 800 10 800 ÷ 10 =1080 10 800 − 1080 = £9720	9720	3	M1 for $\dfrac{10}{100} \times 12\,000$ or sight of 1200 or 2400 or 10 800 or 9600 M1 (dep) for $\dfrac{10}{100} \times (12\,000 - \dfrac{10}{100} \times 12\,000)$ or sight of 1080 A1 cao Alternative markscheme M2 for $12000 \times \left(1 - \dfrac{10}{100}\right)^2$ (M1 for $12000 \times \left(1 - \dfrac{10}{100}\right)$) A1 cao
3	$7r - 5r = -20 - 2$	−11	2	M1 for $7r + 2 = 5r - 20$ or $\dfrac{7r}{5} + \dfrac{2}{5} = r - 4$ or 7r − 5r = −20 −2 or $\dfrac{7r}{5} - r = -4 - \dfrac{2}{5}$ A1 cao

Paper 5505

No		Working	Answer	Mark	Notes
4	(a)		−1, 0, 1	2	B2 for −1, 0, 1 only (B1 for −1, 0 or 0,1 or −1, 1 or −2, -1, 0, 1 only)
	(b)		(−1,−1)(0,−1) (1,−1) (0, 0) (1, 0) (1, 1)	3	B3 for 6 points correct (B2 for 3 points correct) (B1 for 1 point correct) *NB: −B1 for each additional point over six*
5			$5n + 1$	2	B2 oe (B1 for $5n$ seen) NB: n = gets B1 max
6	(a)	Triangle with vertices at (0,0) (0,−2) and (3,0)		2	M1 for correct orientation A1 cao
	(b)	Rotation, 180°, centre (0,1) Enlargement sf −1 centre (0,1)		2	B2 for 180° 'rotation' centre (0, 1) or for Enlargement sf - 1 centre (0,1) (B1 for any two of the three parts) NB: B0 if additional transformation is included
7		Bisector of ∠BAC Arc around A Region	See overlay	3	B3 cao (B2 for <u>either</u> two correct boundaries, no shading/ wrong shading <u>or</u> one correct boundary, one incorrect boundary with valid shading) (B1 for <u>either</u> two incorrect boundaries but one drawn from A and one intersection, with valid shading <u>or</u> one correct boundary) Ignore shading outside the triangle
8			Length Volume Area	3	B1 for Length B1 for Volume B1 for Area

Paper 5505

No		Working	Answer	Mark	Notes
9	(a)	Unbiased question with choices		2	B1 for unbiased question
					B1 for at least 2 choices
	(b)	Leading question and a restricted sample		2	Classification 1: A biased question
					Classification 2: A restricted sample of people
					Classification 3: Not specifying a range of foods
					Classification 4: Nothing to do with eating habits
					B2 reasons which satisfy 2 different classifications
					(B1 a reason which satisfies one classification)
10	(a)	$6 \times 10^2 \times 8 \times 10^4$ $48 \times 10^6 = 4.8 \times 10^7$	4.8×10^7	3	M1 for $6 \times 10^a \times 8 \times 10^b$ oe, a and b integers including 0
					A1 for 48×10^6 oe
					A1 cao
	(b)	$200\,000 + 30\,000 = 230\,000$	230 000	2	B2 cao
					(B1 for sight of 200 000 or 30 000 or 2.3×10^5
					or 23×10^4)
11	(a)	$x^2 + xy + xy + y^2$	$x^2 + 2xy + y^2$	2	M1 for at least 3 of the 4 terms correct
					A1 cao
	(b)		25	2	M1 for recognising 3.47 + 1.53 (= 5)
					A1 cao
12	(i)	Tangent 90° to diameter /radius/ line from (through) centre	27°	4	B1 for 27° cao
					B1 for reason
	(ii)	180 –(90+ "27")	63°		B1 ft for 90–"27" if not 63°
		angle in semicircle (is 90°)/Alternate segments /angle at centre twice at circumference			B1 for reason
13	(i)		p^9	1	B1 cao
	(ii)		$6q^6$	2	B2 for $6q^6$
					(B1 for sight of $\dfrac{6q^9}{q^3}$ or $3q \times 2q^5$ or $3q^4 \times 2q^2$
					or $6 \times q \times q \times q \times q \times q \times q$ or final answer of the form kq^6, $k > 0$)

Paper 5505

No	Working	Answer	Mark	Notes
14 (a)(i)		152	2	B1 cao
(ii)		177		B1 cao
(b)			3	B1 for median marked at 167 B1 ft for postion of box with its ends at "152" and "177" B1 for position of whiskers with ends at 132 and 182 NB: For any points plotted between 141 and 149 give a tolerance of an extra ± 1 square
15	(arc =) $\dfrac{40}{360} \times 2\pi \times 9$ $= 2\pi$	$2\pi + 18$	4	M1 for $\dfrac{40}{360} \times$ M1 for $2\pi \times 9$ M1 (dep) for $\dfrac{40}{360} \times 2\pi \times 9$ oe A1 for $\dfrac{18 \times \pi}{9} + 18$ oe exact form
16 (i)		1	1	B1 cao
(ii)		$\dfrac{1}{16}$	1	B1 cao accept 0.0625
(iii)		64	1	B1 cao condone ± 64

Paper 5505

No	Working	Answer	Mark	Notes
17 (a)	$F \propto 1/x^2$ $F = k/x^2$ $4 = k / 3^2$ $F = 36/x^2$	$F = \dfrac{36}{x^2}$	3	M1 for $F = k/x^2$ seen or implied. $(k \neq 1)$ M1 (dep) for subst. or sight of $k = 36$ A1 for $F = 36/x^2$
(b)		9	1	B1 ft for 9 (ft on $F = kx^n$, $n \neq 0$)
(c)	$64 = \dfrac{36}{x^2}$ $x^2 = \dfrac{36}{64}$ $x = \pm\dfrac{3}{4}$	$\dfrac{6}{8}$	2	M1 for $x^2 = \dfrac{"36"}{64}$ A1 for $\dfrac{6}{8}$ oe (condone $\pm$) *SC: Use of $F = kx^2$ max M1 M1 A0 B1 ft M0 A0* *SC: Use of $F = \dfrac{k}{\sqrt{x}}$* *max M1 M1 A0 B0 M1 ($\sqrt{x} = \dfrac{4\sqrt{3}}{64}$) A0*
18	$\left(5 + \sqrt{3}\right)\left(5 - \sqrt{3}\right) = 5 \times 5 - 5\sqrt{3} + 5\sqrt{3} - \sqrt{3}\sqrt{3}$ $= 5 \times 5 - 3$ $\dfrac{22}{\sqrt{22}} = \dfrac{22\sqrt{22}}{22}$	$\sqrt{22}$	3	B1 for correct expansion $25 - 5\sqrt{3} + 5\sqrt{3} - \sqrt{3}\ \sqrt{3}$ with 1st three terms reducing to 25 **without** any errors seen B1 (indep) for $\sqrt{3}\ \sqrt{3} = 3$ B1 for $\sqrt{22}$ coming from $\dfrac{22}{\sqrt{22}}$ (S.C $\dfrac{(5+\sqrt{3})(5-\sqrt{3})\sqrt{22}}{22}$ gets B1)

Paper 5505

	No		Working	Answer	Mark	Notes
19	(a)			60 40	2	B1 cao B1 cao
	(b)			correct bars	2	B1 for $30 < x \leq 40$ with an area of 2½ squares B1 for $40 < x \leq 70$ with an area of 3 squares SC: $\dfrac{0}{4}$ give M1 if clearly using area or frequency density
20	(a)		$6x + 8 - 12x + 15$	$-6x + 23$	2	M1 for 3 of the 4 terms $6x$, $+8$, $-12x$, $+15$ correct A1 cao
	(b)			$32x^5 y^{15}$	2	B2 cao (B1 for two of 32, x^5, y^{15})
	(c)		$\dfrac{(n+1)(n-1)}{n+1} \times \dfrac{2}{n-2}$ $\dfrac{2(n-1)}{n-2}$	$\dfrac{2(n-1)}{n-2}$	3	M1 for $k(n+1)(n-1)$ M1 dep for $\dfrac{(n+1)(n-1)}{(n+1)} = n-1$ A1 for $\dfrac{2(n-1)}{n-2}$
21			Vertices at $\left(-3, -1\tfrac{1}{2}\right), \left(-4\tfrac{1}{2}, -1\tfrac{1}{2}\right), \left(-3, -4\tfrac{1}{2}\right)$		3	B1 for all sides $\times 1\tfrac{1}{2}$ B1 for correct orientation with 2 vertices almost correct B1 cao

No	Working	Answer	Mark	Notes
22	Total = 3 + 5 + 2 (=10) $$\frac{3}{10} \times \frac{3}{10} \times \frac{5}{10}\left(=\frac{45}{1000}\right), \frac{3}{10} \times \frac{3}{10} \times \frac{2}{10}\left(=\frac{18}{1000}\right)$$ $$\frac{5}{10} \times \frac{5}{10} \times \frac{3}{10}\left(=\frac{75}{1000}\right), \frac{5}{10} \times \frac{5}{10} \times \frac{2}{10}\left(=\frac{50}{1000}\right)$$ $$\frac{2}{10} \times \frac{2}{10} \times \frac{3}{10}\left(=\frac{12}{1000}\right), \frac{2}{10} \times \frac{2}{10} \times \frac{5}{10}\left(=\frac{20}{1000}\right)$$ $$3 \times \left(\frac{"45"}{1000}+\frac{"18"}{1000}+\frac{"75"}{1000}+\frac{"50"}{1000}+\frac{"12"}{1000}+\frac{"20"}{1000}\right)$$ $$\frac{660}{1000}$$	$\frac{660}{1000}$ oe	5	M3 for all six expressions seen OR their combined equivalents (M2 for four expressions seen OR their combined equivalents) (M1 for two expressions seen OR their combined equivalents) M1 sum of 18 relevant products condone 1 slip A1 for $\frac{660}{1000}$ oe *SC: without replacement maximum M4 A0* SC: Just 2 beads: Answer either $\frac{38}{100}$ oe OR $\frac{28}{90}$ oe B1

Paper 5505

No	Working	Answer	Mark	Notes
23 (a)(i)		$6\mathbf{b} - 6\mathbf{a}$	2	B1 for $6\mathbf{b} - 6\mathbf{a}$ oe
(ii)		$6\mathbf{a}$		B1 for $6\mathbf{a}$ oe
(b)	$\overrightarrow{EX} = \overrightarrow{EB} + \overrightarrow{BX}$ $= 12\mathbf{b} + \tfrac{1}{2}\,\overrightarrow{BC}$	$12\mathbf{b} - 3\mathbf{a}$	2	M1 for $\overrightarrow{EX} = \overrightarrow{EB} + \overrightarrow{BX}$ oe vector journey in a form ready for straightforward substitution A1 for $12\mathbf{b} - 3\mathbf{a}$ oe
(c)	$\overrightarrow{AY} = \tfrac{5}{3}\overrightarrow{AB}$ or $\overrightarrow{BY} = \tfrac{2}{3}\overrightarrow{AB}$ $\overrightarrow{EY} = 16\mathbf{b} - 4\mathbf{a}$ or $\overrightarrow{XY} = 4\mathbf{b} - \mathbf{a}$ $\overrightarrow{EY} = 4\overrightarrow{XY}$ or $\overrightarrow{EX} = 3\overrightarrow{XY}$ or $\overrightarrow{EY} = \tfrac{4}{3}\overrightarrow{EX}$	Printer Answer	3	B1 for either $\overrightarrow{AY} = \tfrac{5}{3}\overrightarrow{AB}$ or $\overrightarrow{BY} = \tfrac{2}{3}\overrightarrow{AB}$ oe B1 ft for either $\overrightarrow{EY} = 16\mathbf{b} - 4\mathbf{a}$ or $\overrightarrow{XY} = 4\mathbf{b} - \mathbf{a}$ ft only on parts (*a*) and (*b*) B1 for either $\overrightarrow{EY} = 4\overrightarrow{XY}$ or $\overrightarrow{EX} = 3\overrightarrow{XY}$ or $\overrightarrow{EY} = \tfrac{4}{3}\overrightarrow{EX}$ oe **plus** conclusion of *E, X, Y* on the same straight line
24 (a)(i)		$(5, -4)$	4	B1 cao
(ii)		$(2, -9)$		B1 cao
(iii)		$(2, 4)$		B1 cao
(iv)		$(1, -4)$		B1 cao
(b)		$(x-2)^2 - 4$	4	B4 for $(x-2)^2 - 4$ oe eg. $x^2 - 4x$ (B3 for $(x+2)^2 - 4$ or $(x-2)^2 + 4$) (B2 for $x^2 - 4$ or $(x-2)^2$ OR $x^2 + bx,\ b \neq 0$ OR $(x+2)^2 + 4$ OR $f(x-2) - 4$) (B1 for $x^2 + 4$ or $(x+2)^2$ or $ax^2 + bx$ or $x^2 + bx + c$ OR $x - 2 - 4$ or $x^2 - 2 - 4,\ a, b, c \neq 0$)

Paper 5506

No		Working	Answer	Mark	Notes
1	(a)	$V = \pi \times 4^2 \times 10$	$502 - 503 \text{ cm}^3$	2	M1 for $\pi \times 4^2 \times 10$
					A1 $502 - 503$
	(b)	$P^2 = 10^2 + 8^2$	$\sqrt{164} < 13$	3	M1 for sight of correct right angled triangle
		$P = \sqrt{164}$			M1 for $10^2 + 8^2$
					A1 for conclusion based on a correct calculation
					Or 12.8 seen
2	(a)(i)	2×30	$2 \times 2 \times 3 \times 5$	4	M1 for systematic method, eg division, factor trees (at least one prime)
					A1 cao
	(ii)	2×48	$2^5 \times 3$		M1 for systematic method, division, factor trees (at least one prime)
					A1 cao
	(b)		12	1	B1 cao
	(c)	$2^5 \times 3 \times 5$	480	2	B2 cao
					B1 for $2^5 \times 3 \times 5$ or any correct common multiple

No	Working	Answer	Mark	Notes
3 (a)		$150 < C \leq 200$	2	M1 use of cum freq to find the cost of the 20th or 20.5th car OR $\frac{1}{2}\Sigma f$ th or $\frac{1}{2}(\Sigma f + 1)$ th car. A1 eg 150 to 200, 150 – 200
(b)		No, because the 21st value is in the same interval	1	B1 for 20.5th or 21st value in the same internal consistent with 'a' OR Refers to the median value being low in the interval (statement to be mathematically correct) See additional sheet
(c)	$80\% = 5200$ $\dfrac{5200}{80} \times 100$	6500	3	M1 for $(100 – 20)\% = 5200$ M1 for $\dfrac{5200}{"80"} \times 100$ A1 cao

Paper 5506

No		Working	Answer	Mark	Notes
4	(a)	$x^2(x+1) = 230$	AG	2	M1 for $x \times x \times (x+1)$ or $x \times x \times x + 1$ oe, $x^2(x+1)$, $x^2 \times x + 1$ A1 cao from $x \times x \times (x+1)$, no need to see 230
	(b)	5 – 150 6 – 252 5.1 – 158.7 5.2 – 167.6 5.3 – 177.0 5.4 – 186.6 5.5 – 196.6 5.6 – 207.0 5.7 – 217.7 5.8 – 228.8 5.9 –240.2 5.85 – 234.4	5.8	4	B2 for trial between 5.8 and 5.9 inclusive evaluated (B1 for trial between 5 and 6 inclusive evaluated) B1 for different trial between 5.8 and 5.85 (not including 5.8) B1 dep on at least are previous B1 5.8, 5.81, 5.811
5		$\pi \times \left(\dfrac{15}{2}\right)^2 = 176.715$	88.4 cm^2	3	M1 for $\pi \times \left(\dfrac{15}{2}\right)^2$ seen A1 88.3 – 88.4 B1 for cm² (independent)

Paper 5506

No		Working	Answer	Mark	Notes
6	(a)	$5 = 0.5x + 1$	8	2	M1 for $5 = 0.5x + 1$ A1 cao
	(b)		$y = \dfrac{1}{2}x + c$	1	B1 for $y = \dfrac{1}{2}x + c$, c ≠ 1, oe
	(c)		$x = 2y - 2$ OR $x = 2(y - 1)$	2	M1 for correctly multiplying both sides by 2 or correctly isolating $\dfrac{x}{2}$ A1 for $x = 2(y - 1)$, $x = \dfrac{y-1}{0.5}$, $\dfrac{y-1}{\frac{1}{2}}$ oe SC B1 for x= 2y -1
7		$4x - 6y = 22$ $15x + 6y = 54$ $19x = 76$	$x = 4$, $y = -1$	4	M1 for coefficients of x or y the same followed by correct operation, allow one arithmetical error A1 cao M1 (dep) for correct sub for other variable A1 cao Trial and improvement 0 marks unless both correct values of x and y found
8	(a)	$\text{SF} = \dfrac{10}{6}$ $\dfrac{10}{6} \times 4.8 = 8$	8	2	M1 for sight of $\dfrac{10}{6}$ or $\dfrac{6}{10}$ or 1.67 or better or $\dfrac{CD}{10} = \dfrac{4.8}{6}$ A1 cao
	(b)	$\dfrac{10}{6} \times 4.5 - 4.5 = 3$	19.8	2	M1 for use of SF from "a" to find AC or BC or $\dfrac{BC}{4.5} = \dfrac{4}{6}$ and adding 4 sides A1 cao

Paper 5506

No	Working	Answer	Mark	Notes
9	$\dfrac{6\times10^{15}}{3.2\times10^{8}}$ 1.875×10^{7}	4.3×10^{3}	3	B3 for 4.3×10^{3} to 4.34×10^{3} (B2 for 1.875×10^{7} oe or 4300 to 4340, final answer of 1.9×10^{7} B1 for sight of 6×10^{15} oe or 3.2×10^{8} oe)
10	$8.5\times\tan38$ $=8.5\times0.7813$ $\dfrac{8.5}{\sin(90-38)}=\dfrac{AB}{\sin38}$ $AB=\dfrac{8.5\times\sin38}{\sin(90-38)}$ $=\dfrac{5.2331}{0.788}=6.64$	6.64	3	M1 for correct use of trig, eg $\tan38=\dfrac{opp}{8.5}$ M1 for $8.5\times\tan38$ A1 $6.64-6.641$ OR M1 for correct substitution into the sine rule M1 (dep) for correct rearrangement for $AB=$ A1 $6.64-6.641$
11 (a)		No, as you would expect about 100. Yes, as it is possible to get 200 sixes with a fair dice	1	B1 for a consistent answer See additional sheet

Paper 5506

No	Working	Answer	Mark	Notes
(b)	$\dfrac{1}{6}, \dfrac{5}{6}$ + labels		3	B1 for $\dfrac{5}{6}$ on the red dice, *not six* branch B1 for a fully complete tree diagram with all branches labelled B1 for $\dfrac{1}{6}$ and $\dfrac{5}{6}$ on all remaining branches as appropriate
(c)(i)	$\left(\dfrac{1}{6}\right)^2$	$\dfrac{1}{36}$	2	M1 $\left(\dfrac{1}{6}\right)^2$ or $\dfrac{1}{6} \times \dfrac{1}{6}$ only or 0.28 A1 $\dfrac{1}{36}$ or 0.03 or better
(ii)	$1 - \left(\dfrac{5}{6}\right)^2$ OR $\dfrac{1}{6} \times \dfrac{5}{6} + \dfrac{5}{6} \times \dfrac{1}{6} + \dfrac{1}{6} \times \dfrac{1}{6}$	$\dfrac{11}{36}$	3	M2 for $1 - \left(\dfrac{5}{6}\right)^2$ or $1 - \dfrac{5}{6} \times \dfrac{5}{6}$ A1 cao OR M1 for $\dfrac{1}{6} \times \dfrac{5}{6}$ oe M1 for 2 or 3 only of $\dfrac{1}{6} \times \dfrac{5}{6}, \dfrac{5}{6} \times \dfrac{1}{6}$, "a" A1 for $\dfrac{11}{36}$ or 0.31 or better

Paper 5506

No	Working	Answer	Mark	Notes
12 (a)	$\pi \times 30 \times \dfrac{7.5^2}{3} - \pi \times 10 \times \dfrac{2.5^2}{3} = 1767 - 65$	1700	3	M1 for either $\pi \times 30 \times \dfrac{7.5^2}{3}$ or $\pi \times 10 \times \dfrac{2.5^2}{3}$ M1 (dep) for difference A1 $1700 - 1702$ **SC** B1 Using d instead of r, $6800 - 6808$
(b)	$\dfrac{S}{2\pi d} = \sqrt{h^2 + d^2}$ $\left(\dfrac{S}{2\pi d}\right)^2 = h^2 + d^2$	$h = \sqrt{\dfrac{S^2 - 4\pi^2 d}{4\pi^2 d^2}}$	3	M1 for correctly isolating $\sqrt{h^2+d^2}$ or h^2+d^2 or $h+d$ or kh^2 or kh M1(indep) squaring both sides A1 $h = \sqrt{\dfrac{S^2 - 4\pi^2 d^4}{4\pi^2 d^2}}, \quad h = \dfrac{\sqrt{S^2 - 4\pi^2 d^4}}{2\pi d}$ $h = \sqrt{\left(\dfrac{S}{2\pi d}\right)^2 - d^2}$
(c)	$\left(\dfrac{30}{20}\right)^2 \times 450$ or $450 \div \left(\dfrac{20}{30}\right)^2$	1012.5	2	M1 for sight of correct SF^2 including 4:9 A1 1010 to 1013

Paper 5506

No	Working	Answer	Mark	Notes
13 (a)	$\dfrac{2x(x+20)}{2}=400$	As given	2	M1 $\dfrac{2x(x+20)}{2}$ or $\dfrac{2x\times x+20}{2}$ or $2x(x+20)=800$ A1 cao following correct working, no need for $=400$ *SC B1* $2x\times x+\dfrac{1}{2}\times 2x(10-\dfrac{x}{2})\times 2$
(b)	$\dfrac{-20\pm\sqrt{20^2-4\times1\times(-400)}}{2}$ $=\dfrac{-20\pm44.721}{2}$	12.361	3	M1 for correct sub, up to signs, in the quad formula A1 for 44.7 or $\sqrt{2000}$ A1 for 12.3606 – 12.361, ignore negative solution T.I B3 for 12.361 OR Completing the square M1 for $(x+10)^2$ seen A1 for $-10\pm\sqrt{500}$ A1 for 12.3606 – 12.361 ignore negative solution

Paper 5506

No		Working	Answer	Mark	Notes
14	(a)	$0.5 \times 8 \times 15 \times \sin 70^0$	56.4	2	M1 for correct sub into area formula
					A1 56.38 – 56.4
	(b)	$AB^2 = 8^2 + 15^2 - 2 \times 8 \times 15 \times \cos 70^0 = 206.9$	7.84	4	M1 for correct sub into cos rule
					A1 for 206.9 - 207 or 14.38 – 14.4
		EITHER			EITHER
		$0.5 \times AB \times CX =$ '56.38'			M1 for use of area rule to find CX
					A1 7.83 – 7.84
		OR			OR
		$\dfrac{\sin B}{8} = \dfrac{\sin 70}{\sqrt{'206.9'}}$			M1 for correct use of sine rule to find sin B or sin A and then sight of 15sin B *or* 8 sin A
		$B = 31.5$			A1 7.83 – 7.84
		15 sin '31.5'			

Paper 5506

No		Working	Answer	Mark	Notes
15	(a)	$4a^2 - 4a + 1 - (4b^2 - 4b + 1) =$	AG	3	Expansion Method
					M1 for a correct expansion of any one of the three terms
					M1(dep) on an attempt to expand all 3 terms and show LHS = RHS
					A1 fully correct algebra
		$4(a^2 - b^2) - 4(a - b)$			RHS exp is $4\left(a^2 + ab - a - ba - b^2 + b\right)$
		$4(a - b)(a + b - 1)$			
		OR			OR Factorisation Method
		$\big((2a - 1) - (2b - 1)\big)\big((2a - 1) + (2b - 1)\big)$			M1 for attempt to use difference of 2 squares on LHS
		$(2a - 2b)(2a + 2b - 2)$			M1 for one bracket correctly simplified
					A1 fully correct
	(b)	Any 2 odd square numbers have the above form		3	B1 'any 2 square nos have the above form' (may be implied by sight of $(2a-1)^2 - (2b-1)^2$ in part (b))
					B1 first reason
		If a and b are both even or odd then $a - b$ is even, so $4(a - b)$ is a multiple of 8			B1 second reason
		If one of a,b is odd, then $a + b - 1$ is even, so $4(a + b - 1)$ is a multiple of 8			SC B1 for $(2r + 1)^2 - (2r - 1)^2$
					B1 for 8r
16	(a)	$g_L = \dfrac{2 \times 4.495}{1.35^2 \times \sin 30.5}$	9.719	4	B2 for any 4 of 4.505, 1.25, 29.5, 4.495, 1.35, 30.5 seen (B1 for any two or three seen)
					B1 for 11.710 – 11.7103
		$g_u = \dfrac{2 \times 4.505}{1.25^2 \times \sin 29.5}$	11.710		B1 cao 9.719 – 9.71904
	(b)	Round, until lower and upper bounds agree	10	1	B1 for 10 + reason " they agree to this level of accuracy"

Paper 5506

No		Working	Answer	Mark	Notes
17	(a)(i)		xy	3	B1 cao
	(ii)		y^2		B1 for y^2 or $y \times y$
	(iii)		$\dfrac{x}{2}$		B1 for $\dfrac{x}{2}$ or $0.5x$ or $2^{-1}x$
	(b)	Divide to get $2y = 1$	$q = -1$	2	M1 for $2y = 1$ or $\dfrac{x}{2} = 32$ or $p + q = 5$ or $1 + p + 2q = 5$
			$p = 6$		A1 cao
18	(a)	$x^2 - 2mx + m^2 - k$	$k = m^2$	2	M1 for correct exp of $(x - m)^2$ or correct completion of the square eg $\left(x - \dfrac{2m}{2}\right)^2 - \left(\dfrac{2m}{2}\right)^2$
					A1 cao
					SC B1 for $k = -m^2$
	(b)(i)	Min value is $-m^2$	$-m^2$	3	M1 for recognition that min value occurs when $(x - m)^2 = 0$ (either (b)(i) or (b)(ii) correct implies this M1)
	(ii)	$x = m$	m		A1 ft on 'k', " $-k$" gets M1 A0
					A1 cao
19		$0.06 \times 0.05 = 0.003$	No	2	M1 for 0.06×0.05
					A1 correct conclusion based on 0.003 or 0.06 x 0.05 stated as $\neq 0.0011$
					OR M1 for statement that for the two events to be independent $P\,(\text{BL and CL}) = P(\text{BL}) \times P(\text{CL})$

Paper 5506

No	Working	Answer	Mark	Notes
20		50 50 4	3	B1 50 or $\dfrac{100}{2}$ B1 for 50 or "*a*" B1 4 or $\dfrac{360}{90}$ oe

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