**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

International General Certificate of Secondary Education

# MARK SCHEME for the November 2003 question papers

## 0580/0581 MATHEMATICS

| | |
|---|---|
| **0580/01, 0581/01** | **Paper 1 (Core), maximum raw mark 56** |
| **0580/02, 0581/02** | **Paper 2 (Extended), maximum raw mark 70** |
| **0580/03, 0581/03** | **Paper 3 (Core), maximum raw mark 104** |
| **0580/04, 0581/04** | **Paper 4 (Extended), maximum raw mark 130** |

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

• CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the November 2003 question papers for most IGCSE and GCE Advanced Level syllabuses.

**Grade thresholds** taken for Syllabus 0580/0581 (Mathematics) in the November 2003 examination.

| | maximum mark available | minimum mark required for grade: | | | |
|---|---|---|---|---|---|
| | | A | C | E | F |
| Component 1 | 56 | - | 46 | 35 | 28 |
| Component 2 | 70 | 51 | 28 | 16 | - |
| Component 3 | 104 | - | 68 | 44 | 38 |
| Component 4 | 130 | 101 | 59 | 36 | - |

The threshold (minimum mark) for B is set halfway between those for Grades A and C.
The threshold (minimum mark) for D is set halfway between those for Grades C and E.
The threshold (minimum mark) for G is set as many marks below the F threshold as the E threshold is above it.
Grade A* does not exist at the level of an individual component.

## TYPES OF MARK

Most of the marks (those without prefixes, and 'B' marks) are given for accurate results, drawings or statements.

- **M** marks are given for a correct method.

- **B** marks are given for a correct statement or step.

- **A** marks are given for an accurate answer following a correct method.

## ABBREVIATIONS

| | |
|---|---|
| a.r.t. | Anything rounding to |
| b.o.d. | Benefit of the doubt has been given to the candidate |
| c.a.o. | Correct answer **only** (i.e. no 'follow through') |
| e.e.o. | Each error or omission |
| o.e. | Or equivalent |
| SC | Special case |
| s.o.i. | Seen or implied |
| ww | Without working |
| www | Without wrong working |
| $\sqrt{}$ | Work followed through after an error: no further error made |
| $\not\sqrt{}$ | Work followed through and another error found |

# CAMBRIDGE
INTERNATIONAL EXAMINATIONS

**November 2003**


INTERNATIONAL GCSE


MARK SCHEME

MAXIMUM MARK: 56


SYLLABUS/COMPONENT: 0580/01, 0581/01

MATHEMATICS

Paper 1 (Core)
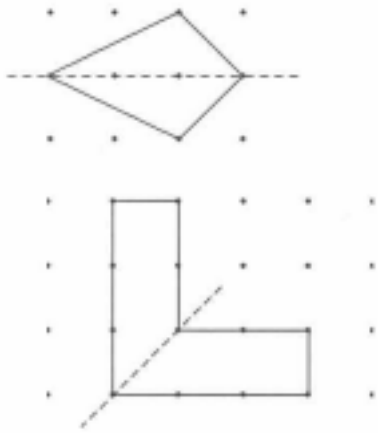
| Question Number | | Mark Scheme Details | | | Part Mark |
|---|---|---|---|---|---|
| 1 | | 400 (grams) | 1 | | 1 |
| 2 | | ($)2.7(0) | 2 | **M1** for $\frac{15}{100} \times 18$ o.e. <br><br> **SC1** for $\frac{85}{100} \times 18 = 15.3$ | 2 |
| 3 | (a) | $\frac{2}{5}$ | 1 | Accept equivalent fractions, decimals, percentages (with sign) | 2 |
| | (b) | 0 | 1 | accept $\frac{0}{5}, \frac{0}{k}$ do not accept, none, not but condone it with 0 | |
| 4 | (a) | 126° | 1 | | |
| | (b) | 40(%) | 2 | **M1** for $\frac{144}{360} \times 100$ o.e. | 3 |
| 5 | | 1.71(01…) | 2 | **M1** for 5 sin 20° or 5 cos70° or 1.7 | 2 |
| 6 | | 6 or $\frac{6}{1}$ | 2 | **M1** for $\frac{60}{10}$, $\frac{\frac{1}{1}}{\frac{1}{6}}$, $\frac{1}{10}{60}$ | 2 |
| 7 | | 144° | 3 | **M2** for $\frac{(2 \times 10 - 4) \times 90}{10}$ or <br><br> $\frac{(10 - 2) \times 180}{10}$ or <br><br> $180 - \frac{360}{10}$. <br><br> After 0, **SC1** for answer 36° | 3 |
| 8 | | 1250 ≤ r.l. < 1350 | 1 + 1 | **SC1** if reversed | 2 |
| 9 | (a) | $10x^2 – 15xy$ | 2 | **B1** for one term correct | |
| | (b) | $6x (x + 2)$ | 2 | **M1** for $6(x^2 + 2x)$ or $x(6x + 12)$ or $2(3x^2 + 6x)$ or $2x(3x + 6)$ or $3(2x^2 + 4x)$ or $3x(2x + 4)$ | 4 |
| 10 | (a) | 87° | 1 | | |
| | (b) | 28° | 1 | | |
| | (c) | 62° √ | 1 | f.t. is (90 – y) | 3 |

| 11 | |  Any line through the centre | 1<br><br>1<br><br>1 | Lines may be freehand but must go completely through the shape | 3 |
|----|-----|------------------------------------|---|---------------------------------------------|---|
| 12 | | x = 4, y = 12 | 3 | **M1** for attempting to eliminate one unknown by a correct method<br>**A1** for one correct value (x or y) | 3 |
| 13 | **(a)** | (i)      2.4096… | 1 | | |
| | | (ii)      2.41  √ | 1 | f.t. from (i) | 4 |
| | **(b)** | 19.3 or 19.32(16…) | 2 | **B1** for 2.68 seen or implied by 19.2… | |
| 14 | **(a)** | Monday, Tuesday and Saturday | 1 | All three and no extras | |
| | **(b)** | -2o | 3 | **B1** for –14 seen<br>+ **M1** for (their –14) ÷ 7 | 4 |
| 15 | **(a)** | (i)      0.28 | 1 | | |
| | | (ii)      0.275 | 1 | | |
| | | (iii)      0.2857… or 0.286 | 1 | | 4 |
| | **(b)** | $\dfrac{275}{1000}$ , 28%, $\dfrac{2}{7}$ or equivalent √ | 1 | f.t. from **(a)** | |
| 16 | **(a)** | 4.58(m) | 2 | **M1** for $\sqrt{5^2 - 2^2}$ s.o.i. e.g. √21 | |
| | **(b)** | 66.4o or 66.3o – 66.45o | 2 | **M1** for $\cos^{-1}\dfrac{2}{5}$ o.e. incl √ | 4 |

| 17 | (a) | 3 | 1 | $10^8$ etc. penalise once only | **4** |
|----|-----|---|---|-------------------------------|---|
|  | (b) | -4 | 1 | accept –04 | |
|  | (c) | 0 | 1 | | |
|  | (d) | -2 | 1 | | |
| 18 | (a) | 0.4 or 2.6 | 2 | **B1** for one correct<br>**SC1** if (0.4,0) (2.6,0) | **6** |
|  | (b) | (i)　　　0 | 1 | | |
|  |  | (ii)　　Correct line from x = -1 to<br>　　x = 4 | 1 | Must be ruled | |
|  | (c) | (0,1), (4,5) √ | 2 | **B1** for one correct<br>f.t. from **(b) (ii)** | |

# CAMBRIDGE
INTERNATIONAL EXAMINATIONS

**November 2003**

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 70

SYLLABUS/COMPONENT: 0580/02, 0581/02

MATHEMATICS

Paper 2 (Extended)

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

\* indicates that it is necessary to look in the working following a wrong answer

| 1 | 0.5 or $\frac{1}{2}$ c.a.o. | 1 | |
|---|---|---|---|
| 2 | (-)4504 | 1 | Allow (-)4500 |
| 3 | **(a)** 121 <br> **(b)** $(n + 1)^2$ | 1 <br> 1 | Allow 49, 64, 81, 100, 121 <br> $n^2 + 2n + 1$ |
| 4 | 3/2500, 1/8, 0.00126 | 2\* | **M1** for all 3 evaluated as decimals (or fractions or percentages or stand. form) <br><br> **SC1** reversed order |
| 5 | **(a)** -1, $\sqrt{36}$ <br><br> (b) $\sqrt{2}$ , $\sqrt{30}$ | 1 <br> 1 | Allow −1, ±6 <br> **SC1 (a)** −1 **and (b)** $\sqrt{36}$ , $\sqrt{2}$ , $\sqrt{30}$ |
| 6 | I = mr/5 | 2\* | **M1** for $\frac{240 \times r \times m}{100 \ (\times 12)}$ o.e. |
| 7 | 66.7 | 2 | **M1** for $\frac{2.4}{3.6} \times 100$ o.e. |
| 8 | **(a)** -1 <br> **(b)** 5k | 1 <br> 1 | |
| 9 | **(a)** 32000 <br> **(b)** 254<u>50</u>     255<u>50</u> | 1 <br> 1, 1 | **SC1** both correct and reversed |
| 10 | 11.5(2) | 3\* | **M1** F = kv$^2$  **M1** k = 18/40$^2$ or better |
| 11 | **(a)** 3110 <br><br><br><br> **(b)** 322 | 2\* <br><br><br><br> 1 √ | **M1** for 1936 ÷ 0.623 or 1936 x 1.61 <br> Allow 3107.54, 3107.5, 3108 or 3107.3 <br> **SC1** 3107 <br> 1000000 ÷ **(a)** |
| 12 | **(a)** 45, 225 <br> **(b)** 157.5 | 1, 1 <br> 1 | Allow 158 |
| 13 | **(a)** 5.5 or 5½ <br> **(b)** 21.5 | 1 <br> 2\* | **M1** 172 ÷ 8 |
| 14 | **(a)** $\frac{x+3}{x(x+1)}$ <br><br> **(b)** -3 | 3\* <br><br> 1 √ | **M1** 3(x + 1) - 2x <br> **M1** denominator x(x + 1) |

| 15 | (a) | angle bisector of angle P | 2* | **M1** correct construction method **A1**$\pm1^o$ |
|---|---|---|---|---|
| | | | | **SC1** for accurate line but no arcs |
| | (b) | radius from T or U | 2* | **M1** radius drawn, meets **(a)** and O |
| | | | | labelled. **A1**$\pm1^o$ |

| 16 | (a) | A(2,0)    B(0,-6) | 1, 1 | **SC1** correct and reversed |
|---|---|---|---|---|
| | (b) | 6.32 | 2* | **M1** (AB$^2$) = "(0 –2)"$^2$ + "(-6 -0)"$^2$ from |
| | | | | **(a)** |
| | (c) | (1,-3) | 1 √ | |

| 17 | (a) | 20 | 1 | |
|---|---|---|---|---|
| | (b) | 98 | 1 | |
| | (c) | 62 | 1 | |
| | (d) | 124 | 1 | |
| | (e) | 36 | 1 √ | **(b) – (c)** |

| 18 | (a) | 5.8 x 10$^8$ | 1 | |
|---|---|---|---|---|
| | (b) | 98 | 2* | **M1** figs 58 ÷ figs 59 or figs 9830508 |
| | (c) | 10200 | 2* | **M1** figs 59 ÷ figs 58 x 10$^n$ or $\dfrac{1}{\textbf{(b)}}$ x 10$^n$ |
| | | | | n = 3 or 6 |

| 19 | (a) | -6 | 2 | **M1** 1 – 2(7/2) |
|---|---|---|---|---|
| | (b) (i) | 0.4 | 2 | **M1** $\dfrac{5x}{2}$ o.e., 2 - 4x = x or better |
| | (ii) | (0.4, 0.2) | 1 | |

| 20 | (a) (i) | -$^2$/$_3$**p** + **q** | 2* | **M1** use of **AQ** = $\pm^2$/$_3$**p** $\pm$ **q** or **AO** + **OQ** |
|---|---|---|---|---|
| | (ii) | -$^3$/$_4$**q** + **p** | 2* | **M1** use of **BQ** = $\pm^3$/$_4$**q** $\pm$ **p** or **BO** + **OP** |
| | (b) | $^1$/$_3$**p** – $^1$/$_2$**q** | 2* | **M1** -$^1$/$_4$**q** + $^1$/$_3$**BP** |

| 21 | (a) | 60x + 80y ≤1200 seen | 1 | Allow 0.6x + 0.8y ≤ 12 |
|---|---|---|---|---|
| | (b) | x ≥ y | 1 | |
| | (c) | line y = x | 1 | |
| | | line through (20,0) and (0,15) | 2* | **M1** intention  **A1** accurate |
| | | shading out or R labelled | 1 | Dep. on both lines |
| | (d) | 20 c.a.o. | 1 | Allow 20, 0 or 20 + 0 |

**Total 70**

**TOTAL MARKS 70**

# CAMBRIDGE
INTERNATIONAL EXAMINATIONS

**November 2003**

INTERNATIONAL GCSE

## MARK SCHEME

## MAXIMUM MARK: 104

### SYLLABUS/COMPONENT: 0580/03, 0581/03

### MATHEMATICS
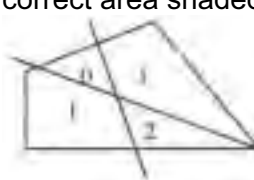
### Paper 3 (Core)

| Question Number | Mark Scheme | Part Marks | Notes | Question Total |
|---|---|---|---|---|
| 1 a) | 24 | 1 | | |
| b) | 25 or $5^2$ | 1 | | |
| c) | 27 or $3^3$ | 1 | | |
| d) | 23 | 1 | | |
| | 29 | 1 | | |
| e) | 26 | 1 | condone 6, 26 or 6 x 26 | |
| f) | 28 cao | 1 | | |
| g) | 21 and 27 | 1 | condone 21 x 27 | **8** |
| 2 a) i) | 1300 or 1 pm | 1 | | |
| ii) | 1030 | 1 | allow 10.30, 10:30 etc | |
| iii) | 9 | 2 | **B1** for either 24 or 33 seen or **M1** for 2 correct horizontal lines drawn or 24 and 33 marked on axis | |
| b) i) | 4.35, 8.7(0) | 2 | **B1** for one correct | |
| ii) | Correct straight line (through (10, 8.6 to 8.8) | 2 | **P1** for (5, 4.2 to 4.4) or (10, 8.6 to 8.8) | |
| iii) | 9.2(0)   (± 0.1) | 1 | no ft. | |
| iv) | 575   (± 5) | 1 | no ft. | **10** |
| | | | | **18** |
| 3 a) | 6000 | 2 | **M1** for 25 x 30 x 8 | |
| b) i) | art 4400 | 3 | **M2** for $\pi$ x $10^2$ x 14 or **SC1** for $\pi$ x $5^2$ x 14 | |
| ii) | art 10400 | 1 √ | ft *their a + bi* | |
| iii) | art 13.9 | 3 √ | ft for (*their bii*) ÷ (25 x 30) **M2** for (*their bii*) ÷ (25 x 30) oe or **M1** for (*their bi*) ÷ (25 x 30) | **9** |
| 4 a) | 4, 7, 6, 4, 4, 2, 3 | 2 | **SC1** for 5 or 6 correct or 7 correct tallies | |
| b) | 1 cao | 1 | | |
| c) | 2 cao | 2 | **M1** *for* attempt at ranking list seen | |
| d) | 2.5 cao | 2 | **M1** *their* $\sum f(x) \div \sum f$ imp by 2.5 seen | |
| e) i) | $0.23(3....)$ or $\dfrac{7}{30}$ | 1 √ | allow 23% ft from their table | |
| ii) | $0.3$ or $\dfrac{3}{10}$ or $\dfrac{9}{30}$ | 1 √ | ft from their table | |
| f) | 40 | 1 √ | ft *their* table x 10.  Allow 40/300 | **10** |
| | | | | **19** |
| 5 a) | 6 | 1 | | |
| | –4 | 1 | | |
| b) i) | Rotation through 180° about (2.5, 6) o.e. | **M1** **A1** **A1** | Half turn **M1 A1**, –1 for "symmetry" allow correct description of point | |
| ii) | Enlargement s.f. 3 centre (1,7) | **B1** **B1** **B1** | accept scale 3, x3 etc accept 'B' for (1,7) | |
| c) i) | 3 cao | 1 | ignore units | |
| ii) | 1 : 9 cao | 2 | **SC1** for 27 seen **M1** for correct answer nlt | |
| d) | $\dfrac{-2}{3}, \dfrac{-6}{9}$ , –0.66 or better | 2 | **SC1** for $\dfrac{2}{3}$ oe or –k | **13** |

| 6 | a) | i) | 27 | 1 | | |
|---|---|---|---|---|---|---|
| | | ii) | 6 | 2 | **M1** for (39 - 3) ÷ 6 | |
| | | iii) | $\dfrac{P-3}{6}$ oe | 2 | **M1** for P–3 seen or $\dfrac{P}{6} = \dfrac{6x+3}{6}$ oe seen | |
| | b) | i) | 4x + 3 | | **M1** for 9x + 4 – 2x – (3x + 1) oe allow 9x + 4 – 2x – 3x + 1 oe for **M1** or **SC1** for 4x or (+)3 in answer space | |
| | | ii) | 10, 16 and 23 | 3 | **M1** for 9x + 4 = 49 oe **A1** for x = 5 | **10** |
| | | | | | | **23** |
| 7 | a) | i) | 44 | 2 | **SC1** for 40 to 48 | |
| | | ii) | 52 | 3 | **B1** for 6 or 8 or 12 or 9 or 21 or 28 or 32 or 112 seen +M1 for adding 6 rectangles o.e. | |
| | | iii) | cuboid or rectangular prism | 1 | allow rectangular cuboid but not cube or cubical | |
| | | iv) | 52 | 1 √ | ft from *their aii* (not strict ft) | |
| | | v) | 24 | 2 | **M1** for 2 x 3 x 4 | |
| | b) | i) | 2(pq + qr + pr) oe as final answer | 2 | **SC1** for pq or qr or pr seen or imp. for both parts. Other letters used consistently MR–1 | |
| | | ii) | pqr as final answer | 2 | **M1** for pqr seen | **13** |
| 8 | a) | | 12.5 NB 4021 answer 12.5 working uses 75 and 800 | 3 | **M1** for 7.5 x 12 oe or 80/12 oe seen +**M1** for $\dfrac{90-80}{80}$ x100 (explicit) or $\dfrac{7.50-6.66....}{6.66....}$ x100 (explicit) after M0 **SC2** for *figs* 124 to 126 ww or **SC1** for 112.5 | |
| | b) | | 120 minutes | 3 | **B1** for $\dfrac{2}{5}$ or 180 or $\dfrac{3}{5}$ x 300 seen +**M1** for $\dfrac{2}{5}$ x 300 oe or 300-180 | |
| | c) | i) | Accurate ⊥ bisector of AB, with arcs ±1°±1mm complete inside figure | 2 | **SC1** if accurate without arcs or incomplete line. Ignore extra lines | |
| | | | Accurate bisector of <C with arcs *as above* | 2 | **SC1** if accurate without arcs or incomplete line *as above* | |
| | | ii) | correct area shaded  | 2 √ | Areas marked as diagram ft from clear intention to draw perp. bisector and angle bisector | **12** |
| 9 | a) | i) | 150 (km) | 1 | | |
| | | ii) | 15 000 000 oe (√) | 2 | **MI** for *their* a)i) x 100 x 1000 or **SC1** for *their* a)i) x $10^n$ when n>0 | |
| | b) | i) | 1270 to 1320 | 2 | **M1** for *their* 8.6 x *their* 150 must have some evidence for *their* 8.6 | |
| | | ii) | (0)45 to (0)48 oe | 1 | | |
| | | iii) | 245 to 248 | 2 | **SC1** for any answer in the range 180 < x < 270 | **8** |
| | | | | | | **20** |

| 10 a) | 1 6 15 20 15 6 1<br>Sum 64<br>1 7 21 35 35 21 7 1<br>Sum 128 | 1<br>1<br>2<br>1 | **SC1** if 6 or 7 correct | |
|---|---|---|---|---|
| b) i) | 512    accept $2^9$ | 2 | **SC1** for 256 | |
| ii) | $2^n$ | 2 | **SC1** for 2 x 2 x 2 seen or description | |
| c) | 165 330 462<br>The first 6 numbers repeated in reverse order | 1<br>1 | | **11** |
| | | | | **11** |
| | | | **TOTAL** | **104** |

**November 2003**

INTERNATIONAL GCSE

## MARK SCHEME

## MAXIMUM MARK: 130

### SYLLABUS/COMPONENT: 0580/04, 0581/04

### MATHEMATICS

### Paper 4 (Extended)

Marks in brackets are totals for questions or part questions.

| 1 | (a) | | 144:96 | B1 | After **B0**, allow **SC1** for reversed "correct" final ans. www2 |
|---|---|---|---|---|---|
| | | | Final answer 3:2 or 1.5:1 or 1:0.667 | B1 | |
| | | | | (2) | |
| | (b) | (i) | 32 (children) | B1 | |
| | | (ii) | 54 (adults off) | B1 | |
| | | (iii) | 110 (adults on) | B1 | |
| | | (iv) | 26 (=$x$) w.w.w. | B1 | |
| | | | | (4) | |
| | (c) | | $300 \times \dfrac{4}{thier(6+5+4)}$ | M1 | |
| | | | 80 children | A1 | www2 |
| | | | | (2) | |
| | (d) | (i) | Final Ans. 21 13 or (0)9 13 pm | B1 | Condone hrs but hrs and minutes $\Rightarrow$ **BO** |
| | | (ii) | 7 h 20 min (o.e) $\times \dfrac{10}{110}$ $\left(\text{or} \times \dfrac{100}{110}\right)$ | M1 | Implied by 6 h 40 min or 400 min |
| | | | 40 min | A1 | www2 |
| | | | | (3) | |
| | | | | **(11)** | |
| 2 | (a) | (i) | 1.8(02..) | B1 | Throughout (a)(i)(ii)(iii) <u>NO</u> misreads allowed. |
| | | (ii) | $1.99^2 = \dfrac{80h}{3600}$ o.e. | M1 | Must be $h$, not $\sqrt{h}$ |
| | | | ($h$ =) 178(.2    ) | A1 | ww2 (<u>Must</u> be correct – e.g. 178.4 $\Rightarrow$ **MO** ww) |
| | | (iii) | $A^2 = \dfrac{hm}{3600}$ | M1 | (First step must be correct from correct formula for <u>first</u> **M1**.) |
| | | | | | Correctly squares at any stage |
| | | | $3600A^2 = hm$ | M1 | Correctly multiplies at any stage |
| | | | $\dfrac{3600A^2}{m} = h$ | M1 | Correctly divides at any stage |
| | | | | | Only a correct answer in this form can get **M3**. |
| | | | | (6) | |
| | (b) | (i) | $(x + 4)(x - 4)$ | B1 | i.s.w. solutions in all (b) |
| | | (ii) | $x(x - 16)$ | B1 | Condone loss of **final** bracket in any (b) |
| | | (iii) | $(x - 8)(x - 1)$ | B2 | |
| | | | | (4) | |

| | | | | | |
|---|---|---|---|---|---|
| (c) | (i) | $x(3x - 9) = 2x^2 - 8$ o.e. | M1 | No error seen and some working to reach final quoted equation. Must have = 0. (E = established) | |
| | | $2x^2 - 8 = 3x^2 - 9x$ | | | |
| | | $x^2 - 9x + 8 = 0$ | E1 | | |
| | (ii) | $x = 1$ | B1 | | |
| | | $x = 8$ | B1 | | |
| | (iii) | time = 15 (sec)    c.a.o. | B1 | | |
| | | distance = 120 (m)    c.a.o. | B1 | | |
| | | | (6) | | |
| | | | **(16)** | | |

| | | | | | |
|---|---|---|---|---|---|
| 3 | (a) | (i) | $17^2 + 32^2 - 2.17.32 \cos40°$ | M2 | Allow **M1** for sign error or correct implicit eqn |
| | | | $\sqrt{\text{their } 479.54}$ | M1 | Dep M2. <u>NOT</u> for $\sqrt{225\cos40°}$ or $\sqrt{2146}$ |
| | | | Answer in range 21.89 to 21.91 (m) | A1 | www4 |
| | | (ii) | $\dfrac{\sin T}{17} = \dfrac{\sin 40°}{\text{their } 21.9}$ | M1 | or $17^2 = 32^2 + (\text{their } 21.9)^2 - 2.32.(\text{their } 21.9)\cos T$ |
| | | | $\sin T = \dfrac{17\sin 40°}{\text{their } 21.9}$    (0.499) | M1 | $\cos T = \dfrac{32^2 + (\text{their } 21.9)^2 - 17^2}{2.32.(\text{their } 21.9)}$ |
| | | | 29.9° | A1 | Accept 29.93° to 29.94°. www3 |
| | | | | (7) | |
| | (b) | (i) | 125°    c.a.o. | B1 | <u>All</u> bearings must be $0° \leqslant \theta \leqslant 360°$ to score |
| ** | | (ii) | 305° | B1√ | √ (180° + their 125°) correct |
| ** | | (iii) | 335° or 334.9° | B1√ | √ (their 305° + their $T$) correct |
| | | | | (3) | |
| | (c) | | $\tan(\hat{F}) = \dfrac{30}{32}$ o.e. | M1 | <u>or</u> $F\hat{X}T = \tan^{-1}\dfrac{32}{30}$ <u>clearly</u> identified. ° |
| | | | 43.2° | A1 | (43.15239°) www2 <u>NOT</u> 43.1 |
| | | | | (2) | |
| | | | | **(12)** | |

| | | | | | |
|---|---|---|---|---|---|
| 4 | (a) | | Scale correct | S1 | $0 \leqslant t \leqslant 7$ (14 cm) and 0 – 60 ↑ (12 cm) |
| | | | 8 correct plots (0 , 0), (1 , 25), | | Allow **P2** for 6 or 7 correct |
| | | | (2 , 37.5), (3 , 43.8), (4 , 46.9), | P3 | **P1** for 4 or 5 correct |
| | | | (5 , 48.4), (6 , 49.2), (7 , 49.6) | | Accuracy better than 2mm horizontally. In correct square ↑ |
| | | | Reasonable curve through 8 points | C1 | Not for linear or <u>bad</u> quality |
| | | | | (5) | |

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| | | | | |
|---|---|---|---|---|
| (b) | (i) | $f(8) = 49.8$ or $49\frac{103}{128}$ o.e. | B1 | Do not accept improper fractions |
| | | $f(9) = 49.9$ or $49\frac{231}{256}$ o.e. | B1 | |
| | (ii) | $f(t$ large$) \approx 50$ | B1 (3) | |
| (c) | (i) | Tangent drawn at $t = 2$ | B1 | Not a chord and not daylight |
| | | Uses vert/horiz using scale | M1 | Can be given after **B0** if line not too far out |
| ** | | Answer correct for their tangent | A1 √ | |
| | (ii) | Acceleration or units | B1 (4) | Accept $ms^{-2}$, $m/s^2$, m/s/s. |
| (d) | (i) | Straight line through (0 , 10) | B1 | ⎫ Must be ruled and full length to earn B2 |
| | | Straight line gradient 6 | B1 | ⎭ |
| ** | (ii) | one √ intersection value for $t$ | B1√ | |
| ** | | Second √ $t$ <u>and</u> range | B1√ | |
| | (iii) | Distance = area (under curve) | M1 | |
| | | First particle (f($t$)) goes further | A1 (6) **(18)** | |
| Marking final answers throughout this question | | | | |
| 5 (a) | (i) | 0.2                          o.e. | B1 | Accept 2/10, 1/5, 20% |
| | (ii) | 0.4                          o.e. | B1 | After first **B0**, condone "2 in 10" type answers. |
| | (iii) | 0.5                          o.e. | B1 | Never condone 2 : 10 type |
| | (iv) | 0.1                          o.e. | B1 | |
| | (v) | 0 | B1 (5) | Accept "none", "nothing", 0/10, nil, zero |
| (b) | (i) | 2/10 x 1/9 | M1 | |
| | | 1/45                          o.e. | A1 | Accept 2/90, 0.0222      2.22%   www2 |
| | (ii) | 3/10 x 2/9 | M1 | |
| | | 1/15                          o.e. | A1 | Accept 6/90 etc, 0.0666(or 7), 6.66 or 6.67% www2 |
| | (iii) | (their) 1/45 + (their) 1/15 | M1 | |
| | | 4/45                          o.e. | A1 | Accept 8/90 etc, 0.0888(or 9), 8.88 or 8.89% www2 |
| | (iv) | <u>Clearly</u> 1 – (their) 4.45  o.e. | M1 | Alternative method must be complete |
| | | 41/45 | A1 (8) **(13)** | Accept 82/90 etc, 0.911, 91.1%  www2 |

| | | | | | |
|---|---|---|---|---|---|
| 6 | (a) | | $\pi(30)^2$ (50) | M1 | |
| | | | 141 000 (cm³) | A1 | (141 300 to 141 430)    www2 |
| | | | | (2) | |
| | (b) | (i) | 18 (cm) | B1 | |
| | | (ii) | $\cos\left(\dfrac{1}{2}\angle AOB\right)$ = (their 18)/30 | M1 | Allow M1 or M2 at similar stages for other methods e.g. sin A = 18/30 then (180° − 2A) |
| | | | x2 | M1dep | |
| | | | ∠AOB = 106.26°    c.a.o | A1 | Must have 2 decimal places seen. |
| | | | | (4) | ww1 (condone = 106.3 afterwards) |
| | (c) | (i) | (their) $\dfrac{106.3}{360}$ used | M1 | |
| | | | $\pi(30)^2$ used | M1 | |
| | | | 834 to 835.3 (cm²) | A1 | www3 |
| | | (ii) | $\dfrac{1}{2}.30.30\sin$ (their) 106.3° or | M1 | |
| | | | $\dfrac{1}{2}.48.18$ | | |
| | | | 431.8 to 432 (cm²) | A1 | www2 |
| | | (iii) | Ans. Rounds to 403 cm² | A1 | |
| | | | | (6) | |
| | (d) | (i) | 50 x (their) 403 | M1 | |
| ** | | | 20 100 to 20 200 (cm³) | A1√ | √ correct for their "403"    www2 |
| ** | | (ii) | 20.1 to 20.2 (litres) | B1√ | √ their previous answer ÷ 1000 |
| | | | | (3) | |
| | (e) | | $k\left[\dfrac{1}{2}\text{their ( a) } - \text{their ( d) ( i)}\right]$ | M1 | k = 1 (cm³) k = .001 (litres) k = other ⇒ consistent conversion error. |
| | | | 50.3 to 51 (litres) | A1 | Marking final answer    www2 |
| | | | | (2) | |
| | | | | **(17)** | |
| 7 | (a) | (i) | F $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$ | M1 A1 | M marks for letters, A marks for descriptions. If no letter given, allow **SC1** for correct description |
| | | (ii) | D x = 1 | M1 A1 | |
| | | (iii) | E (2 , −1) | M1 A1 | |
| | | (iv) | C (s.f.) 3 | M1 A1 | |
| | | (v) | A Shear | M1 A1 | |
| | | | | (10) | |

| | | | | | |
|---|---|---|---|---|---|
| (b) | | $(-1 \ -2) \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix}$ or QP | M1 | Penalty −1 for <u>each</u> wrong one thought possible. | |
| | | $(-11 \ -17)$ <u>final</u> ans | A2 | Allow **SC1** for one correct | |
| | | $(1 \ 2 \ 3) \begin{pmatrix} -1 \\ 2 \\ 3 \end{pmatrix}$ or RS | M1 | | |
| | | (12) | A2 | Brackets essential here. | |
| | | | (6) | Allow SC1 for 12 or −1 + 4 + 9 | |
| | | | **(16)** | | |
| 8 | (a) (i) | $10 < M \leqslant 15$ | B1 | Must clearly mean this and not 32 | |
| | (ii) | Midpoints 5, 12.5, 17.5, 22.5, 32.5 | M1 | Allow for 3 or 4 correct | |
| | | $\sum fx$ (60 + 400 + 490 + 540 + 780) | M1 | (2270) Needs previous **M1** or only marginally out | |
| | | (their) 2270 ÷ 120 | M1 | dep previous **M1** | |
| | | 18.9 (2) (kg) | A1 | www4 | |
| | | (1) | | | |
| | (iii) | 36° | B1 | | |
| | | | (6) | | |
| | (b) | Horizontal scale 2 cm ≡ 5 units | S1 | $0 \leqslant M \leqslant 40$. Accuracy < 2 mm. | |
| | | (numbered or used correctly) | | If **S0** (e.g. 1 cm ≡ 5 units) can score **B5** | |
| | | | | If **S0** (e.g. 0, 10, 15) can only score on correct width bars. Penalty −1 for polygon superimposed. | |
| | | Heights 3k, 16k, 14k, 12k, 4k cm | B5 | If not scored, decide on their "k" and allow SC1 for each "correct" bar. (Needs ⩾ 2 bars to decide on value of k if k ≠ 1.) | |
| | | Their k = 1 | B1 | | |
| | | | (7) | | |
| | | | **(13)** | | |
| 9 | (a) (i) | (Diagram) 5 only | B1 | | |
| | (ii) | (Diagram) 4 only | B1 | | |
| | (iii) | (Diagram) 2 only | B1 | | |
| | | | (3) | | |

| (b) | Diagram 1 9 (cm²) | B1 | 9.00 to 3 s.f. |
|-----|-------------------|-----|----------------|
| | Diagrams 2 and 3 have same area | B1 | |
| | One of them $\frac{1}{2}$ x 3 x 3 | M1 | |
| | $4\frac{1}{2}$ (cm²) | A1 | www2 |
| | Diagram 4 $\frac{1}{4}$ π3²    s.o.i. | M1 | (7.07 cm²) |
| | $\frac{1}{2}$ x 6 x 6 – their 9π/4 | M1 | indep. i.e. 18 – kπ where k numerical |
| | 10.9 (cm²) | A1 | www3 |
| | Diagram 5 $22\frac{1}{2}$°    s.o.i | M1 |  (bc = $\sqrt{72}$ ) |
| | 6 tan$22\frac{1}{2}$° | M1 | (2.485) (This is AD or DE) |
| | $\frac{1}{2}$ (6 – their 2.485) x 6 | dep.M1 | or 18 – $\frac{1}{2}$ x 6 x their 2.485. (o.e.) |
| | 10.5 (cm²) | A1 | www4 |
| | | (11) | |
| | | **(14)** | |