This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners’ meeting before marking began.

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.

The grade thresholds for various grades are published in the report on the examination for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses.

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

CIE is publishing the mark schemes for the October/November 2006 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.
1 (a) (i) \(5(x + 2)(x - 2)\) seen

After B0, allow B1 for partial factorisation, e.g. \(5(x^2 - 4)\) or \((5x + 10)(x - 2)\)

or \((x + 2)(x - 2)\) seen etc

(ii) Final answer \(\frac{x - 2}{2(x - 1)}\) oe including \(\frac{2 - x}{2x - 2}\) asc

After B0, allow B1 for Their (a)(i) soi or \(5x - 10\) oe nww

or quadratic factors of denominator including \((x - 1)(x + 2)\)

(b) \(\frac{4(y + 5) - 3(y - 3)}{(y - 3)(y + 5)}\) oe soi

If denominator in this form, inner brackets essential
If not in this form, accept quadratic expression with \(y^2\) and \(-15\)

Final answer \(\frac{y + 29}{(y - 3)(y + 5)}\) oc

After M1 A0, allow A1 for correct simplified numerator and denominator seen, not necessarily at the same stage

(c) Final answer \(g = \frac{4 \pi^2 L}{T^2}\) oe cao

Correct final answer involving an expression divided by fraction SCB2

or, in either order, Square their equation ft M1

and Clears fraction, \((gT^2 = 4\pi^2L)\) ft indep M1 3 3 10

2 (a) (i) Final answer \((9, 6)\) or \(x = 9, y = 6\) B1 1 1

(ii) \(\frac{3}{4}\) or \(\frac{6}{8}\) B1 1 1

(iii) \((\pm) 10\) B1 1 1

(b) (i) Final answer \((-12, 2)\) or \(-12, -2\) Condone brackets missing B2 2 2

After B0, allow B1 for \(\begin{pmatrix} -8 \\ 5 \end{pmatrix} + \begin{pmatrix} -4 \\ -3 \end{pmatrix}\) oe or \(\begin{pmatrix} -12 \\ 2 \end{pmatrix}\)

(ii) Trapezium indep B1 1 1 6
3. (a) \[91^2 = 53^2 + 64^2 \pm 2 \times 53 \times 64 \cos (P)\] oe soi
\[
(\cos P =) \frac{53^2 + 64^2 - 91^2}{2 \times 53 \times 64} \quad \text{soi} \quad \left(\frac{-1376}{6784}\right) \left(\approx -0.2028\right)
\]
\[(P =) 101.65^\circ \text{ to } 101.75^\circ\]
If only one or both of other angles alone found,
allow M1 for \[53^2 - 64^2 + 91^2 \pm 2 \times 64 \times 91 \cos (Q)\] or \[64^2 - 53^2 + 91^2 \pm 2 \times 53 \times 91 \cos (R)\]
and A1 for \[(Q=)34.75^\circ \text{ to } 34.85^\circ \text{ or } (R=)43.45^\circ \text{ to } 43.55^\circ\]
Long methods : Allow M2 A1
(b) \[
\sin S = \frac{53 \sin 68}{74} \quad \left(\approx 0.66406\right)
\]
\[S = 41.55^\circ \text{ to } 41.65^\circ\]
A1
P = 70.35 to 70.45° or 112 – their S ft (dep on M1)
A1 3 2
Long methods : Allow M2 A1
(c) \[
\frac{1}{2} \times 53 \times 74 \sin (\text{their } P)
\]
1845 to 1855 (m²) cao
A1 2 2 8

4. (a) \[\text{XBY } = \) 150°\]
B1 1 1
(b) \[\text{XAD } = \text{ XBY } (\approx 150)\]
B1
\[\text{XA } = \text{ XB and AD } (\approx \text{ BC}) = \text{ BY}\]
B1
Conclusion drawn and at least one reason shown SAS needed if too many facts dep B1 3 -
(c) \[\text{AXD } = \text{ BXY soi}\]
B1
Convincingly shows \[\text{DXY } = 60^\circ (\approx \text{ AXB})\]
AG dep B1 2 -
(d) States \[\text{DX } = \text{ XY}\]
B1
Correctly concludes triangle \[\text{DXY } \text{ is equilateral}\]
or \[\text{DY } = \text{ DX and/or XY with a reason}\]
B1
triangle is equilateral dep B1
(c)(d) together \[\text{ΔDCY congruent to } \text{ΔADX and/or } \text{ΔBXY}\]
B1
\[\text{DY } = \text{ DX and/or XY}\]
B1
dep B1
\[\text{ΔDCY is equilateral}\]
B1
dep B1
\[\text{Angle DXY } = 60^\circ\]
B1
dep B1
Numerical values used for other angles cannot gain credit
<table>
<thead>
<tr>
<th>6 (a) Formula</th>
<th>6 (b)</th>
<th>5 (a) (i) ($) 825</th>
</tr>
</thead>
<tbody>
<tr>
<td>For numerical ( \frac{p \pm \sqrt{q}}{r} ), (not ( \pm p )), seen or used,</td>
<td>(i) ($) 16200</td>
<td></td>
</tr>
<tr>
<td>Allow B1 for ( p = -12 ) and ( r = 14 ) and B1 for ( q = 452 ) or ( \sqrt{q} = 21.2 ) soi</td>
<td>(ii) ( (\text{Their} \ 16200) \times 1.08 \times 1.08 ) oe soi</td>
<td></td>
</tr>
</tbody>
</table>
| \( \frac{18895.68}{15000} \) \[ \text{Accept} 18896, 18895.7, 18895 \text{ or } 18900 \] ft | (iii) Figures Their (b)(ii) \(-15000 \) \( \times 100 \) or Their \( 1200 + 1296 + 1399.68 \)
| 15000 | SC B1 |
| 25.95 to 26.05 \( (\%) \) \[ \text{Accept 26} \] ft | or 125.95 to 126.05 \( (\%) \) |
| \( \frac{12}{112} \) | A1 2 2 11 |
| \( \$41500 \) | |

6 (a) Complete square | Allow B1 for \((a + 6/7)^2 \) or \((a + 6/7) \) oe soi |
| and B1 for \( 113/49 \) or square roots such as \( 1.5185 \) or \( 10.63 \) /7 |
| Final answers | Allow B1 for each of 0.66 and -2.38 nww |
| or allow B1 for both 0.661 and -2.375. seen or 0.66 and -2.38 seen (1) |
| B1 4 2 |

(b) | 4x + 6y = 816 seen (leading to 2x + 3y = 408) | B1 1 |
| 3x + 5y = 654 oe seen | B1 1 1 |
| \( x = 78 \) and \( y = 84 \) | B3 3 3 9 |

After B0, allow B2 for one correct answer found with no wrong working |
After B0, allow M1 for correct method to eliminate one variable |
After 3x + 3y = 654 in (ii), allow SC B2 for both \( x = 82 \) and \( y = 81.3 \) or better |

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7 (a) \(2\pi \times 30^2\) \((=1800\pi)\) \((=5655)\) soi M1

\(2\pi \times 30 \times 70\) \((=4200\pi)\) \((=13194)\) soi indep M1

Their \(1800\pi + \text{their } 4200\pi + \pi \times 30^2\) (provided all areas) indep M1

21 650 to 21 750 \((\text{cm}^2)\) A1 4 3

Note Use of \(3\pi 30^2\) may be taken as \(2\times30^2 + \pi 30^2\), unless contradicted

by the addition of extra \(\pi 30^2\), when M0, M1, M1, A0 possible

(b) (i) \(\frac{3\pi}{2} \times 30^3\) \((=18000\pi)\) \((=56549)\) M1

Their \(18000\pi + \pi \times 30^2 \times 70\) \((=81000\pi)\) \((=254469)\) (both volumes) indep M1

254 to 255 \((\text{litres})\) cao A1 3 2

(ii) Their \(\frac{(b)(i)}{3}\) \((=84.8..)\) M1

1 minute 24.5 seconds to 1 minute 25.5 seconds cao A1 2 2

(iii) (Length = ) Figures \(\frac{\text{Their } (b)(i)}{\frac{1}{3} (0.4 + 0.6) \times 0.3}\) M1

Correct conversion of units (using 1000) indep M1

1.690 to 1.700 \(\text{m}\) or 169.0 to 170.0 \(\text{cm}\) [Unit essential in this case] cao A1 3 3 12

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8 (a) (i) 21, 28

(ii) \[ \frac{1}{2} \times 7 \times (7 + 1) = 28 \quad (= T_7) \] or better seen

(iii) 5050

(iv) 25 250 or 5 \times \text{their (iii) ft}

(v) Attempts to use \( T_{500} \) - their (iv) (provided their (iv) < their \( T_{500} \))

100 000

(b) (i) \( S_6 = 56 \)
\( S_7 = 84 \)

After B0 + B0, allow M1 for correct expansion of either or both expressions

(ii) \[ (7 \times (7 + 1) \times (7 + 2)) \div 6 = 84 \quad (= S_7) \] or better seen

(iii) 1540 seen

(c) (i) \( S_4 - S_3 = (1 \times 4 + 2 \times 3 + 3 \times 2 + 4 \times 1) - (1 \times 3 + 2 \times 2 + 3 \times 1) \)

\[ = 4 + 3 + 2 + 1 (= T_4) \] seen

20 - 10 =10 is enough to score

(ii) \( S_{n+1} - S_n = (n + 1) + n + (n - 1) + \ldots + 2 + 1 = T_{n+1} \) justified

If algebraic methods used, mark strictly, expecting at least one step seen
9
(a) \( \sqrt{104^2 - 100^2} \) or 28.56... oe seen [leading to 28.6 AG ] B1 1 -

(b) (i) 25°
B1 1 1

(ii) (FN =) 100 tan (their 25°) (= 46.63..) M1
(FB =) Their [46.63 - (28.56... or 28.6)] dep M1
18.00 to 18.10 (m) [Expect at least 3 sig figs here] A1 3 3
Alternative methods : M2 A1

(c) (i) \( CN = \sqrt{100^2 + 60^2} \) or \( BC = \sqrt{104^2 + 60^2} \) M1
= 116.6... soi or = 120.06... soi A1
\( \tan BCN = \frac{Their 28.6}{Their CN} \) or \( \sin BCN = \frac{Their 28.6}{Their BC} \) M1
13.70° to 13.80° cao A1 4 3
Alternative methods : still M1 A1 M1 A1

(ii) \( BD = \frac{Their 28.6}{\sin 10} \) (-164 to 165) M1
\( \cos DBA = \frac{104}{Their BD} \) (= 0.63.....) dep M1
50.75° to 50.85° cao A1 3 2 12
or \( DN = \frac{Their 28.6}{\tan 10} \) (= 162.198)
and \( DA = \sqrt{their 162.198^2 - 100^2} \) (=127.7) M1
\( \tan DBA = \frac{Their 127.7}{104} \) dep M1
50.75° to 50.85° A1

Alternative methods : M2 A1
<table>
<thead>
<tr>
<th></th>
<th>Mark Scheme</th>
</tr>
</thead>
</table>
| 10 | Condone inaccuracies of up to 1 mm in plotting and drawing.  
    | If plots are not visible, allow P marks if curve passes within 1 mm of correct plot.  
    | Both P and dep C marks can be recovered following a grossly wrong plot if the plot is ignored and the curve passes within 1 mm of the correct point.  
    | Lined or plain paper used: no penalty, but extend tolerances to 2 mm.  
    | Penalties, only to be applied to any P or C marks earned:  
    | Wrong scale(s): -1 once  
    | Interchanged axes: no penalty if labelled, -1 otherwise  
    | Non-uniform scale(s): -2 after marking as generously as possible  
    | (a) 8(0.03)  
    | Ignore graph for \( x < 1 \) and for \( x > 6 \) throughout rest of question  
    | (b) All 7 points plotted \( \text{ ft } \) (P1 for at least 5 of these \( \text{ ft } \) )  
    | Smooth curve, not grossly thick, through all plotted points, of which at least 5 are correct  
    | (c)  
    | 1.35 to 1.45  
    | 3.55 to 3.70  
    | (d) Drawing tangent at \( x = 4 \) and estimating change in \( y \)  
    | change in \( x \)  
    | 1.20 to 1.40  
    | Accept integer if in range for A1  
    | (e) (i) Ruled straight line within 1 mm of both \((1, 3.5)\) and \((5, 5.5)\)  
    | After L1, allow L1 for a good freehand line through these points, or a ruled line that would pass within 1 mm of the points if longer, or a ruled line that is long enough and passes within 2 mm of the points  
    | (ii)  
    | 1.45 to 1.55 and 4.55 to 4.65  
    | (iii) \( 2x^3 - 5x^2 - 30x + 50 \) \( (= 0) \) or any equivalent equation  
    | Accept \( a = -5, \) \( b = -30 \) and \( c = 50 \)  

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