



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**CAMBRIDGE INTERNATIONAL MATHEMATICS**

**0607/31**

Paper 3 (Core)

**May/June 2016**

MARK SCHEME

Maximum Mark: 96

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**Published**

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This document consists of **6** printed pages.

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**Abbreviations**

|      |                            |
|------|----------------------------|
| awrt | answers which round to     |
| cao  | correct answer only        |
| dep  | dependent                  |
| FT   | follow through after error |
| isw  | ignore subsequent working  |
| oe   | or equivalent              |
| SC   | Special Case               |
| nfw  | not from wrong working     |
| soi  | seen or implied            |

| Question         | Answer                 | Mark        | Part Marks                                                             |
|------------------|------------------------|-------------|------------------------------------------------------------------------|
| <b>1</b> (a) (i) | 356.3                  | <b>1</b>    |                                                                        |
| (ii)             | 360                    | <b>1</b>    |                                                                        |
| (iii)            | 400                    | <b>1</b>    |                                                                        |
| (iv)             | $3.56[31] \times 10^2$ | <b>1</b>    |                                                                        |
| (b) (i)          | 279.14                 | <b>1</b>    |                                                                        |
| (ii) (a)         | 20.86                  | <b>1 FT</b> | <b>FT</b> 300 – <i>their</i> (b)(i)                                    |
| (b)              | 7.47 or 7.472 to 7.473 | <b>1 FT</b> | <b>FT</b> <i>their</i> (b)(ii) $\div$ <i>their</i> (b)(i) $\times$ 100 |
| <b>2</b> (a) (i) | $4^6$                  | <b>1</b>    |                                                                        |
| (ii)             | 4096                   | <b>1</b>    |                                                                        |
| (b) (i)          | 272                    | <b>1</b>    |                                                                        |
| (ii)             | 255                    | <b>1</b>    |                                                                        |
| (c)              | $4^8$                  | <b>1</b>    |                                                                        |
| <b>3</b> (a)     | 27                     | <b>1</b>    |                                                                        |
| (b)              | 10                     | <b>1</b>    |                                                                        |
| (c) (i)          | 50                     | <b>1</b>    |                                                                        |
| (ii)             | 23                     | <b>1 FT</b> | <b>FT</b> <i>their</i> 50 – <i>their</i> 27                            |
| (d)              | $\frac{1}{20}$         | <b>2</b>    | <b>B1 FT</b> for $\frac{\text{their } 23}{460}$                        |

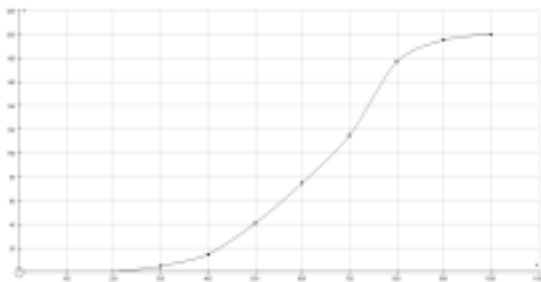
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| Question  | Answer                                                                                                                                                                                                                         | Mark                                                                                                           | Part Marks                                                                            |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|--------------------------|
| 4 (a)     | <table><tr><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td></tr><tr><td>1</td><td>1</td><td>5</td><td>4</td><td>1</td><td>1</td><td>2</td><td>4</td><td>1</td></tr></table> | 26                                                                                                             | 27                                                                                    | 28                                                                                                                                                                                      | 29 | 30 | 31 | 32 | 33 | 34 | 1 | 1 | 5 | 4 | 1 | 1 | 2 | 4 | 1 | 2 | B1 for 4 correct entries |
|           | 26                                                                                                                                                                                                                             | 27                                                                                                             | 28                                                                                    | 29                                                                                                                                                                                      | 30 | 31 | 32 | 33 | 34 |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | 1                                                                                                                                                                                                                              | 1                                                                                                              | 5                                                                                     | 4                                                                                                                                                                                       | 1  | 1  | 2  | 4  | 1  |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (b) (i)                                                                                                                                                                                                                        | 8                                                                                                              | 1                                                                                     |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (ii)                                                                                                                                                                                                                           | 28                                                                                                             | 1                                                                                     |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (iii)                                                                                                                                                                                                                          | 29                                                                                                             | 1                                                                                     |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (iv)                                                                                                                                                                                                                           | 30                                                                                                             | 1                                                                                     |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
| (c) (i)   | $\frac{4}{20}$ oe isw                                                                                                                                                                                                          | 1FT                                                                                                            | FT $\frac{their4}{20}$                                                                |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
| (ii)      | $\frac{11}{20}$ oe isw                                                                                                                                                                                                         | 1FT                                                                                                            | FT $\frac{2 + their5 + their4}{20}$                                                   |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
| 5 (a) (i) | 1                                                                                                                                                                                                                              | 2                                                                                                              | M1 for $5 \times 2 - 2 \times 3 - \frac{1}{2} \times 6$ or better                     |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (ii)                                                                                                                                                                                                                           | 3.2                                                                                                            | 3                                                                                     | M2 for $5B = 12 + 2 + 2$ or better (Allow 1 sign error e.g. $-5B$ )<br>or M1 for $12 = 5B - 2(1) - \frac{1}{2}(4)$ or better                                                            |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (b)                                                                                                                                                                                                                            | -13                                                                                                            | 2                                                                                     | M1 for $7 \times -3 - 4 \times -2$ or better                                                                                                                                            |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (c)                                                                                                                                                                                                                            | $\frac{2y+9}{3}$ oe final answer                                                                               | 2                                                                                     | M1 for correct first step                                                                                                                                                               |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (d)                                                                                                                                                                                                                            | 6 kiwi – 2 kiwi = 840 – 480 oe<br>kiwi =90<br>pomegranate + $2 \times their\ 90 = 480$ oe<br>pomegranate = 300 | M1<br>A1<br>M1<br>A1 FT                                                               | OR<br>M1 for setting up two equations<br>M1 for eliminating one variable<br>A1 kiwi = 90<br>A1 pomegranate = 300<br>second A1 is FT<br>If no working shown SC1 for both answers correct |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
| 6 (a)     | 144                                                                                                                                                                                                                            | 2                                                                                                              | M1 for $\frac{12}{30} [\times 360]$ seen or $48 \times 3$ or $\frac{60}{5} \times 12$ |                                                                                                                                                                                         |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |
|           | (b)                                                                                                                                                                                                                            | Fully correct answer                                                                                           | 3                                                                                     | B2 for correct sectors but no labels<br>or B1 for 1 correct sector<br>or B1for correct 3 labels according to size                                                                       |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |                          |

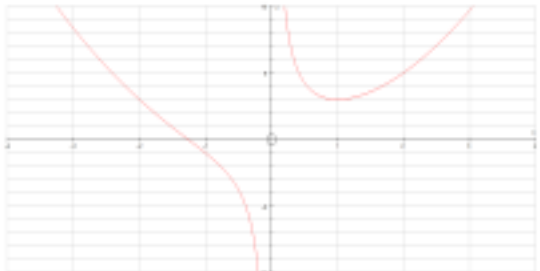
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| Question          | Answer                                      | Mark        | Part Marks                                                                                                      |
|-------------------|---------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------|
| <b>7</b> (a) (i)  | 75                                          | <b>1</b>    |                                                                                                                 |
|                   | (ii) 105                                    | <b>1</b>    |                                                                                                                 |
|                   | (b) $[p = ] 70$                             | <b>1</b>    |                                                                                                                 |
|                   | $[q = ] 20$                                 | <b>1</b>    |                                                                                                                 |
|                   | $[r = ] 20$                                 | <b>1 FT</b> | <b>FT</b> <i>their q</i> or $90 - \text{their } p$                                                              |
|                   | $[s = ] 140$                                | <b>1 FT</b> | <b>FT</b> $70 + \text{their } p$ or $180 - 2 \times \text{their } r$                                            |
| <b>8</b> (a) (i)  | 1.61 or 1.606 to 1.607                      | <b>2</b>    | <b>M1</b> for $\sin 40 = \frac{BC}{2.5}$ or better                                                              |
|                   | (ii) 4.11 or 4.106 to 4.107                 | <b>1 FT</b> | <b>FT</b> $2.5 + \text{their (a)(i)}$                                                                           |
|                   | (b) 1.92 or 1.915...                        | <b>2</b>    | <b>M1</b> for $\cos 40 = \frac{HB}{2.5}$ or better<br>or <b>M1</b> for $2.5^2 - \text{their } 1.61^2$           |
|                   | (c) 1.02 or 1.016 or 1.02 to 1.03           | <b>1 FT</b> | <b>FT</b> $2 \times \text{their (a)(i)} + \text{their (b)} - \text{their (a)(ii)}$                              |
| <b>9</b> (a)      | Correct points plotted<br>(2, 3) and (5, 7) | <b>2</b>    | <b>B1</b> for each correct point                                                                                |
|                   | (b) (3.5, 5)                                | <b>1</b>    |                                                                                                                 |
|                   | (c) $\frac{4}{3}$                           | <b>2</b>    | <b>M1</b> for $\frac{\text{rise}}{\text{run}}$<br>or <b>B1</b> for 1.3                                          |
|                   | (d) $y = \frac{4}{3}x + 4$ oe final answer  | <b>2 FT</b> | <b>FT</b> $y = \text{their (c)} x + 4$ oe<br><b>B1</b> for $y = \text{their } \frac{4}{3}x + k$ or $y = kx + 4$ |
| <b>10</b> (a) (i) | 47.1 or 47.12 to 47.13                      | <b>1</b>    |                                                                                                                 |
|                   | (ii) 565 to 566                             | <b>1 FT</b> | <b>FT</b> $\text{their (a)(i)} \times 12$                                                                       |
|                   | (b) 720                                     | <b>1</b>    |                                                                                                                 |
|                   | (c) 154 to 155                              | <b>1 FT</b> | <b>FT</b> $\text{their (b)} - \text{their (a)(ii)}$                                                             |
|                   | (d) 21.39 to 21.53                          | <b>1 FT</b> | <b>FT</b> $\text{their (c)} \div \text{their (b)} \times 100$                                                   |

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| Question   | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                              | Mark      | Part Marks                                                                                                                                                                 |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----|-----------|----|-----------|----|-----------|-----|-----------|-----|-----------|-----|------------|-----|---|-----------------------------------|
| 11 (a)     | (0, 2), (−1, 1), (−2, 1), (−3, 2), (−2, 3)                                                                                                                                                                                                                                                                                                                                                                                                          | 1         |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| (b)        | (2, −4), (3, −5), (4, −5), (5, −4), (4, −3)                                                                                                                                                                                                                                                                                                                                                                                                         | 2         | <b>B1</b> for translation of $\begin{pmatrix} k \\ -6 \end{pmatrix}$ or $\begin{pmatrix} 2 \\ k \end{pmatrix}$<br>or <b>B1</b> for $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$ |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| (c)        | (0, 6), (3, 3), (6, 3), (9, 6), (6, 9)                                                                                                                                                                                                                                                                                                                                                                                                              | 2         | <b>B1</b> for any enlargement centre (0, 0)<br>or correct shape, wrong position                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| (d)        | 3 : 1                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1         |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| (e)        | similar                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1         |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| 12 (a)     | 700 $[\leq x <]$ 800                                                                                                                                                                                                                                                                                                                                                                                                                                | 1         |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| (b) (i)    | $\frac{(200 + 300)}{2} [= 250]$ oe                                                                                                                                                                                                                                                                                                                                                                                                                  | 1         |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| (ii)       | 638.5                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2         | <b>M1</b> for multiplying midpoints by frequencies (and adding) – implied by 127700                                                                                        |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| (c)        | <table><tr><td><math>x &lt; 300</math></td><td>5</td></tr><tr><td><math>x &lt; 400</math></td><td>15</td></tr><tr><td><math>x &lt; 500</math></td><td>41</td></tr><tr><td><math>x &lt; 600</math></td><td>75</td></tr><tr><td><math>x &lt; 700</math></td><td>115</td></tr><tr><td><math>x &lt; 800</math></td><td>177</td></tr><tr><td><math>x &lt; 900</math></td><td>195</td></tr><tr><td><math>x &lt; 1000</math></td><td>200</td></tr></table> | $x < 300$ | 5                                                                                                                                                                          | $x < 400$ | 15 | $x < 500$ | 41 | $x < 600$ | 75 | $x < 700$ | 115 | $x < 800$ | 177 | $x < 900$ | 195 | $x < 1000$ | 200 | 2 | <b>B1FT</b> for 2 correct entries |
| $x < 300$  | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| $x < 400$  | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| $x < 500$  | 41                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| $x < 600$  | 75                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| $x < 700$  | 115                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| $x < 800$  | 177                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| $x < 900$  | 195                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| $x < 1000$ | 200                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                                                                                                                                                                            |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |
| (d)        | Fully correct curve or ruled polygon<br>                                                                                                                                                                                                                                                                                                                         | 3FT       | <b>FT</b> only if increasing<br><br><b>B2FT</b> for <i>their</i> 4 or 5 points plotted correctly<br>or <b>B1FT</b> for <i>their</i> 3 points plotted correctly             |           |    |           |    |           |    |           |     |           |     |           |     |            |     |   |                                   |

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| Question | Answer                                                                                                    | Mark | Part Marks                                                                                                                                                         |
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| (e) (i)  | 662 (660 to 680)                                                                                          | 1FT  | FT as long as it is an increasing curve                                                                                                                            |
| (ii)     | 230 (230 to 260)                                                                                          | 2FT  | B1 for one correct quartile seen<br>( $756 \pm 5$ or $526 \pm 5$ )<br>FT as long as it is an increasing curve                                                      |
| (iii)    | 12 (8 to 16)                                                                                              | 2FT  | B1 for $188 \pm 4$ seen<br>or M1 for clear method seen on graph<br>FT as long as it is an increasing curve                                                         |
| 13 (a)   | Fully correct sketch<br> | 4    | B1 for minimum in first quadrant<br>B1 for crossing $x$ -axis approximately between $-1$ and $-2$<br>B1 for not crossing $y$ -axis<br>B1 for correct overall shape |
| (b)      | $x = 0$                                                                                                   | 1    |                                                                                                                                                                    |
| (c)      | (1, 3)                                                                                                    | 1    |                                                                                                                                                                    |
| (d)      | 3                                                                                                         | 1FT  | FT <i>their</i> graph                                                                                                                                              |