GCSE Bitesize examinations
General Certificate of Secondary Education

MATHEMATICS
Higher Tier

Paper 1 Non-calculator

Marking scheme

Unless otherwise stated, correct answers only should be accepted.
Answer all questions in the spaces provided

1. (a) \[432 = 3^3 \times 2^4\]
\[522 = 2 \times 3^2 \times 29\] (1 mark)
(b) HCF = 18 (1 mark)

2. AC = 8 cm
\[AC^2 + 6^2 = 10^2\]
\[10^2 - 6^2 = AC^2\]
\[100 - 36 = \sqrt{64}\] (2 marks)

3. (a) (i) \[4n - 1\] (1 mark)
(ii) \[\frac{1}{n^2}\] (1 mark)
(iii) \[n^3 + 3\] or any equivalent (1 mark)
(b) 406 (2 marks)
1 mark for showing 3, 16, 81, 406

4. (a) (2 marks)

(b) (2 marks)
5. (a) 0.375 \quad \text{(1 mark)}
(b) \quad x = 0.24242424\ldots \quad (1)
\quad 100x = 24.24242424\ldots \quad (2)
\quad (2) - (1) \quad 99x = 24
\quad \frac{x}{99} = \frac{24}{99} \quad (2 \text{ marks})
\quad x = \frac{8}{33} \quad \text{(1 mark)}
(You must show working for first two marks)

6. (a) \quad 3a^2b(a + 4b + 3a^3b^2) \quad \text{(1 mark)}
(b) \quad x = 2, \quad x = -\frac{3}{2} \quad \text{(2 marks)}
\quad 1 \text{ mark for showing } (2x + 3)(x = 2)
(c) \quad x = -\frac{3}{2} \quad \text{(2 marks)}
\quad 1 \text{ mark for showing } 3x + 2 + 3x - 3 = 4x - 4 \text{ or equivalent removal of quotient.}

7. (a) \quad \text{Add a bar to the histogram showing the frequency density for the interval 350-499.}
\quad 1 \text{ mark for showing 0.4} \quad \text{(2 marks)}

(b) \quad \frac{1}{4} \quad \text{mark for showing frequency = width x frequency density} \quad \text{(3 marks)}

<table>
<thead>
<tr>
<th>Price (£000s)</th>
<th>0-99</th>
<th>100-249</th>
<th>250-299</th>
<th>300-349</th>
<th>350-499</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>10</td>
<td>60</td>
<td>40</td>
<td>45</td>
<td>60</td>
</tr>
</tbody>
</table>
8. Using a ruler and pair of compasses only, and making sure you leave all construction lines visible:

(a) Construct a triangle of side lengths 4cm, 5cm and 6cm or 2 marks for side lengths to within ± 2mm  
(2 marks)

(b) Construct a square of side length 5cm or 2 marks for side lengths to within ± 2mm  
(3 marks)

9. (2 marks)
10. (a) \( x \leq -\frac{9}{2} \) or equivalent (1 mark)

(b) -3, -2, -1, 0, 1, 2, 3 (1 mark)

(c) -2, -1, 0, 1, 2, 3, 4, 5, 6, 7 (2 marks)

11. (a) Either:

\[
\frac{23}{5} - \frac{7}{3}
\]

\[
= \frac{69}{15} - \frac{35}{15}
\]

\[
= \frac{34}{15}
\]

\[
= 2 \frac{4}{15}
\]

Or:

\[
2 + \left( \frac{3}{5} - \frac{1}{3} \right)
\]

\[
= 2 + \left( \frac{9}{15} - \frac{5}{15} \right)
\]

\[
= 2 \frac{4}{15}
\]

(b) \( \frac{9}{4} \div \frac{3}{5} \) (1 mark)

\[
= \frac{9 \times 5}{4 \times 3}
\]

\[
= \frac{15}{4}
\]

\[
= 3 \frac{3}{4}
\] (1 mark)
12. (a) (i) 

<table>
<thead>
<tr>
<th>1st die</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
</tr>
</tbody>
</table>

1 mark if 2 or less incorrect. (2 marks)

(ii) \( \frac{1}{8} \) or equivalent (2 marks)

(b) \( \frac{5}{12} \) or equivalent (3 marks)

13. (a) Angle ACB 37.5° (1 mark)

(b) Angle BDA 37.5° (2 marks)

(c) Angle ABD 112.5° (2 marks)

1 mark for indicating triangle ABD and 180°

14. (a) Are you in favour of the new road? (2 marks)

1 mark only for each suggestion biased towards either side.

(b) (3 marks)

(i) Range of different places, ie different villages and town
(ii) Different jobs
(iii) Different types of housing or position in each place chosen.

Reasonable equivalents acceptable

(c) 3210 (1 mark)
15. (a) $\frac{1}{7}$ (1 mark)

(b) $2^{12}$ (1 mark)

(c) 49 (2 marks)

16. (a) $2(x + 1) + 2(x + 1)(x + 2) + 2x(x + 2)$ or any equivalent

1 mark for showing $x(x + 1)$ or $(x + 1)(x + 2)$ or $x(x + 2)$ (3 marks)

(b) Length of shortest side = 2 units

OR

1 mark for showing $x^2 + 2x - 8 = 0$ or equivalent

1 mark for showing $(x + 4)(x - 2) = 0$ (3 marks)
17. (a) \( \overrightarrow{EF} = -b \)  
(b) \( \overrightarrow{DB} = -(b + c) \) or \(-b - c\)  
(c) \( \overrightarrow{FD} = a + b \)  
(d) \( \overrightarrow{AO} = \frac{1}{2}(a + b + c) \)  
or \( a + c \)  
or \( b \)  
1 mark each, maximum 2

18. \( x = -1 \pm \sqrt{5} \)  
1 mark for \( a = 1 \), \( b = 2 \), \( c = -4 \)  
1 mark for showing:
\[
-2x \pm \sqrt{(4+16)}
\]
\[
\frac{2}{2}
\]
or 1 mark for showing \( \sqrt{5} \)
19. 3 marks for one error, 2 marks for 2 errors, 1 mark for 3 errors and 0 marks for more errors. (4 marks)

<table>
<thead>
<tr>
<th>Function</th>
<th>Graph</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y = (x - 1)^2$</td>
<td>B</td>
</tr>
<tr>
<td>$y = x^2 + 5x + 6$</td>
<td>A</td>
</tr>
<tr>
<td>$y = 2x^2 + 1$</td>
<td>D</td>
</tr>
<tr>
<td>$y = x^2 - x - 6$</td>
<td>C</td>
</tr>
<tr>
<td>$y = 2(x - 2)^2$</td>
<td>E</td>
</tr>
</tbody>
</table>

20. (a) $2.310 \times 10^3$  
(1 mark for 2310 seen) (2 marks)

(b) $5 \times 10^{-2}$  
(1 mark for $\frac{1}{20}$ or 0.05) (3 marks)

(c) 250 000  
(1 mark for showing $2.5 \times 10^5$) (2 marks)
21. (a) \( 60^\circ \) 
1 mark for showing \( 4\pi = x^\circ / 360 \times 24\pi \) 

(b) \( 2.5 \text{ cm} \) 

22. Solutions: \((0,1), \left( -\frac{3}{5}, -\frac{4}{5} \right) \) 

1 mark for showing \( x^2 + y^2 = 1, \ y = 3x + 1 \) 
1 mark for showing either \( 10x^2 + 6x = 0 \) or \( x = -\frac{3}{5} \)