## Collins

## AQA

GCSE

## Mathematics

## SET B - Higher Tier

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## Answers

## Key to abbreviations used within the answers

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M method mark (e.g. M1 means }1\mathrm{ mark for method)
A accuracy mark (e.g. A1 means }1\mathrm{ mark for accuracy)
B independent marks that do not require method to be shown (e.g. B2 means 2 independent marks)
C communication mark
oe or equivalent
ft follow through
dep dependent on previous mark
cao correct answer only
sc special case
indep independent
```


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Paper 1

| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 1 | $x+3$ | B1 |  |
| 2 | $(x-2)(x+3)=0$ | B1 |  |
| 3 (a) | $\sqrt{52} \mathrm{~cm}$ | B1 |  |
| 3 (b) | $\frac{3}{4}$ | B1 |  |
| 4 | $6 x-12+8=x$ | M1 |  |
|  | $5 x=4$ | M1dep |  |
|  | $x=0.8$ | A1 | oe |
| 5 | Area of any face, i.e. $20 \times 5$ or 100 etc. | M1 |  |
|  | $\begin{aligned} & 2 \times 100+2 \times 50 \\ & +2 \times 200 \end{aligned}$ | M1dep |  |
|  | 700 | A1 |  |
| 6 | $4 x+4-6 x+8$ | M1 | M1 for 3 terms correct |
|  | $4 x+4-6 x+8$ | A1 | A1 for 4 terms correct |
|  | $-2 x+12$ | A1ft | ft on M1, e.g. $\begin{aligned} & 4 x+1-6 x-8 \\ & =-2 x-7 \text { is } \mathrm{M} 1, \\ & \mathrm{~A} 0, \mathrm{~A} 1 \mathrm{ft} \end{aligned}$ |
| 7 | $2 x+100=180$ | M1 |  |
|  | $360 \div 40$ | M1dep |  |
|  | 9 | A1 |  |
| 8 (a) | 230000 | B1 |  |
| 8 (b) | $5 \times 10^{-4}$ | B1 |  |
| 8 (c) | $1.6 \times 10^{8}$ | B2 | B1 for $16 \times 10^{7}$ |
| 9 (a) | -1.5 and 3 | B2 | B1 each answer |
| 9 (b) | (0.75, -6.1) | B1 |  |
| 10 | $x+2=2 x-1$ | M1 |  |
|  | $x=3$ | A1 |  |
|  | 3+2 or $2 \times 3-1$ | M1dep |  |
|  | 5 | A1 |  |
|  | 25 | A1 |  |
| 11 | $\begin{aligned} & x^{2}+2 x+1 \text { or } \\ & x^{2}-2 x-3 \end{aligned}$ | M1 |  |
|  | $\begin{aligned} & x^{3}-3 x^{2}+2 x^{2}- \\ & 6 x+x-3 \end{aligned}$ | M1dep |  |
|  | $x^{3}-x^{2}-5 x-3$ | A1 |  |
| 12 | $\pi \times(r)^{2} \times 6 r$ | M1 | oe |
|  | their $6 \pi r^{3}=48 \pi$ | M1dep |  |
|  | 2 | A1 |  |
| 13 | $x \leqslant 6$ | B1 |  |
|  | $x+y \geqslant 7$ | B1 |  |
|  | $y \leqslant x+1$ | B1 |  |


| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 14 | $\begin{aligned} & 27+9 \sqrt{2}-3 \sqrt{8} \\ & -\sqrt{16} \\ & \hline \end{aligned}$ | M1 | oe |
|  | $\begin{aligned} & 27+9 \sqrt{2}-6 \\ & \sqrt{2}-4 \end{aligned}$ | A1 |  |
|  | $23+3 \sqrt{2}$ | A1 |  |
| 15 | Vertical scale marked to at least 3.5 <br> Bar between 5-10 to a height of 3 <br> Bar between 10-20 to a height of 3.5 <br> Bar between 20-35 to a height of 2 <br> Bar between 35-45 to a height of 1.5 <br> Bar between 45-50 to a height of 1 | B3 | B2 Scale marked and any two bars <br> B1 Scale marked and any 1 bar |
| 16 (a) | 56 | B1 |  |
| 16 (b) | 60 | B1 |  |
| 16 (c) | ACB stated or shown as 32 | B1 |  |
|  | $C A B$ stated or shown as 90 (may be implied by working) | B1 |  |
|  | $58^{\circ}$ | B1 |  |
| 17 | 16 | B2 | B1 for $(\sqrt[3]{64})^{2}$ oe <br> B1 for $\sqrt[3]{64}=4$ |
| 18 (a) | 24 | B1 |  |
| 18 (b) | 31 and 17 seen | M1 |  |
|  | 14 | A1 |  |
| 18 (c) | Valid box plot with <br> Median marked (ft their median) IQR marked (ft their IQR) <br> Minimum value as 5 and maximum as 50 | B2 | B1 any 2 components |
| 19 (a) | $a+\frac{3}{2} b$ | B1 |  |


| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 19 (b) | $\begin{aligned} & \overrightarrow{B C}=\overrightarrow{B A}+\overrightarrow{A O} \\ & +\overrightarrow{O C}=-\mathbf{a} \\ & +\frac{1}{2} \mathbf{b} \\ & \text { or }-\frac{3}{2} \mathbf{b}-\mathbf{a}+O C \\ & =-\mathbf{a}+\frac{1}{2} \mathbf{b} \end{aligned}$ | M1 |  |
|  | 2b | A1 |  |
| 20 | $\begin{aligned} & x=0.733333 \ldots \\ & \text { and } 10 x \\ & =7.33333 \end{aligned}$ | M1 |  |
|  | $9 x=6.6 \text { or } \frac{66}{90}$ | A1 |  |
|  | $3 \frac{11}{15}$ | A1 |  |
| 21 | $\frac{x^{2}}{2}=9$ | M1 |  |
|  | $x=3 \sqrt{2}$ | M1 |  |
|  | Hypotenuse $=6$ | M1 |  |
|  | $6+2 \times 3 \sqrt{2}$ | M1 |  |
|  | $6+6 \sqrt{2}$ | M1 |  |
| 22 | Tree diagram with at least 3 correct probabilities marked or $\mathrm{P}(\mathrm{R}$ and $B)+P(B$ and $R)$ | M2 | M1 for less than 3 correct probabilities marked |
|  | All correct probabilities identified as $\frac{7}{10}$, $\frac{3}{10}, \frac{6}{9}$ oe, $\frac{3}{9}$ oe, $\frac{7}{9}$ and $\frac{2}{9}$ or one of $\frac{7}{10}$ $\times \frac{3}{9}$ or $\frac{3}{10} \times \frac{7}{9}$ | A1 |  |
|  | $\begin{aligned} & \frac{7}{10} \times \frac{3}{9}+\frac{3}{10} \\ & \times \frac{7}{9} \end{aligned}$ | M1dep |  |
|  | $\frac{42}{90}$ or $\frac{7}{15}$ | A1 |  |


| Question | Answer | Mark | Comments |
| :---: | :--- | :---: | :--- |
| 23 | $(2 x+3)(2 x-5)$ <br> $(2 x-3)(x+4)$ <br> $2(x+4)$ <br> $(2 x-3)(2 x+3)$ | B3 | B2 three <br> factorisations <br> B1 two <br> factorisations |
|  | $\frac{2 x-5}{2}$ | B1 |  |
| 24 | Gradient $A B$ <br> $=-\frac{1}{2}$ | M1 |  |
|  | Gradient <br> perpendicular 2 | A1 |  |
| Midpoint $A B$ <br> $=(5,9)$ | B 1 |  |  |
|  | $9=2 \times 5+c$ | M 1 |  |
|  | A1 |  |  |
| $y=2 x-1$ |  |  |  |

Paper 2

| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 1 | $\frac{2}{5}$ | B1 |  |
| 2 | $(7,6)$ | B1 |  |
| 3 (a) | alternate angles | B1 |  |
| 3 (b) | $a+b=180$ | B1 |  |
| 4 | Correct translation, i.e. $(1,1) \rightarrow(-2,-3)$, etc. | B2 | B1 for correct translation of one vector component |
| 5 | $6^{2}+11^{2}$ | M1 |  |
|  | $\sqrt{157}$ | M1dep |  |
|  | 12.5... | A1 |  |
| 6 | $\begin{aligned} & 5 \times 145+9 \times 155 \\ & +12 \times 165+8 \times \\ & 175+6 \times 185 \text { or } \\ & 6610 \end{aligned}$ | M1 |  |
|  | $6610 \div 40$ | M1dep |  |
|  | 165.25 | A1 |  |
| 7 (a) | Any product including a prime that makes 28 | M1 |  |
|  | $\begin{aligned} & 2 \times 2 \times 7 \text { or } \\ & 2^{2} \times 7 \end{aligned}$ | A1 |  |
| 7 (b) | $2 \times 2 \times 5 \times 7$ | M1 |  |
|  | 140 | A1 |  |
| 8 | $4(x+4)=26$ | M1 |  |
|  | $4 x=10$ | M1dep |  |
|  | 2.5 | A1 |  |


| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 9 | 0.85 | B1 |  |
|  | $238 \div 0.85$ | M1 |  |
|  | 280 | A1 |  |
| 10 | $36 \div 3$ or 12 | M1 |  |
|  | $2 \times 12$ or $5 \times 12$ | M1dep |  |
|  | 24 and 60 | A1 |  |
| 11 | $\sqrt{\frac{402}{\pi}}$ or $11.3 \ldots$ | M1 |  |
|  | $11.3 \times \pi+2 \times 11.3$ | M1dep |  |
|  | [58, 58.2] | A1 |  |
| 12 | Arc from $A$ cutting given line | M1 |  |
|  | Arc centred on intersection and crossing original arc plus line drawn and angle $60^{\circ}$ drawn | A1 |  |
|  | $60^{\circ}$ angle bisected | A1 | Angle must be between [26, 32] |
| 13 (a) | $4 x^{2}-8 x+3 x-6$ | M1 |  |
|  | $20 x^{2}-25 x-30$ | A1 |  |
| 13 (b) | $2(x+a)(x+b)$ | M1 | $a b= \pm 3$ |
|  | $2(x+1)(x+3)$ | A1 | $\begin{aligned} & \text { oe eg } \\ & (2 x+2)(x+3) \end{aligned}$ |
| 14 | Triangle between $(3,9),(4,9)$ and $(4,7)$ | B3 | B2 two vertices correct B1 rays marked through $(5,8)$ |
| 15 | $30 \times 1.6$ or 48 | M1 |  |
|  | $\begin{aligned} & \text { (their } 48-40) \div \\ & 40(\times 100) \end{aligned}$ | M1dep |  |
|  | 20 | A1 |  |
| 16 (a) | $(x+3)^{2}$ | M1 |  |
|  | $(x+3)^{2}-9$ | M1dep |  |
|  | $(x+3)^{2}-18$ | A1 |  |
| 16 (b) | $x+3=\sqrt{18}$ | M1 |  |
|  | $x=-3 \pm \sqrt{18}$ | A1 |  |
| 17 | $2(4 x-1)-3(x+1)$ | M1 |  |
|  | $5 x-5=$ | A1 |  |
|  | $\begin{array}{\|l\|} \hline(4 x-1)(x+1) \text { or } \\ 4 x^{2}+4 x-x-1 \\ \hline \end{array}$ | M1 |  |
|  | $4 x^{2}-2 x+4$ | A1 |  |


| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 18 (a) | $\begin{aligned} & y=k x^{2} \text { and } 20= \\ & k \times 2^{2} \end{aligned}$ | M1 |  |
|  | $k=5$ | A1 |  |
|  | 500 | A1 |  |
| 18 (b) | $5=5 \times x^{2}$ | M1 |  |
|  | $\pm 1$ | A1 | Condone omission of $\pm$ |
| 19 | $\begin{aligned} & x(x-6)+2 x+ \\ & x-4+x+30= \\ & 146 \\ & \hline \end{aligned}$ | M1 |  |
|  | $x^{2}-2 x-120=0$ | A1 |  |
|  | $\begin{aligned} & (x-12)(x+10) \\ & =0 \end{aligned}$ | A1 |  |
|  | $x=12$ | A1 |  |
|  | $\frac{8}{146}$ or $\frac{4}{73}$ | A1 |  |
| 20 (a) | $\begin{aligned} & \cos x \\ & =\frac{10^{2}+7^{2}-13^{2}}{2 \times 10 \times 7} \end{aligned}$ | M1 |  |
|  | $-\frac{1}{7}$ | A1 |  |
|  | 98.2 | A1 |  |
| 20 (b) | $\frac{1}{2} \times 7 \times 10 \times \sin$ <br> (their 98.2) | M1 |  |
|  | 34.6... | A1 |  |
| 21 | $\frac{6(3+\sqrt{3})}{(3-\sqrt{3})(3+\sqrt{3})}$ | M1 |  |
|  | $\frac{18+6 \sqrt{3}}{9-3}$ | A1 |  |
|  | $\frac{6(3+\sqrt{3})}{6}$ | A1 |  |
| 22 | 11.5 or 12.5 or 8.25 or 8.35 | M1 |  |
|  | 11.5 and 12.5 and 8.25 and 8.35 | M1dep |  |
|  | $\begin{aligned} & 8.25 \div 12.5 \text { or } \\ & 8.35 \div 11.5 \end{aligned}$ | M1 |  |
|  | Upper 46.6 | A1 |  |
|  | Lower 41.3 | A1 |  |


| Question | Answer | Mark | Comments |
| :---: | :--- | :---: | :---: |
| $\mathbf{2 3}$ (a) | Tangent drawn <br> at 3 | M 1 |  |
|  | $y$-step and $x$-step <br> measured | M1dep |  |
|  | $[0.7,1.1]$ | A 1 ft | ft their tangent |
| $\mathbf{2 3}$ (b) | Attempt to <br> calculate area <br> under curve | M 1 |  |
|  | $[75,85]$ | A 1 ft | ft their area |
|  | Their area $\div 10$ | M 1 dep |  |
|  | $[7.5,8.5]$ | A 1 |  |

## Paper 3

| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 1 | Force $\div$ Area | B1 |  |
| 2 | $\frac{\sqrt{3}}{2}$ | B1 |  |
| 3 | 729 | B1 |  |
| 4 | 125 | B1 |  |
| 5 (a) | $x^{9}$ | B1 |  |
| 5 (b) | $x^{10}$ | B1 |  |
| 6 | $\binom{10}{4}$ | B2 | B1 for each component |
| 7 | -2, -1, 0, 1, 2, 3 | B2 | $\begin{aligned} & \text { B1 for }-3,-2 \text {, } \\ & -1,0,1,2,3 \\ & \text { B1 for }-2,-1,0, \\ & 1,2,3,4 \end{aligned}$ |
| 8 |  | B2 | B1 for any enlargement that reduces the size of the shape and keeps the side in relative ratio. B1 for any 3 sides correct. |
| 9 | $1.5 \div 2$ | M1 |  |
|  | 0.75 | A1 |  |
| 10 (a) | $\frac{4}{10}$ marked on red and $\frac{6}{10}$ marked on blue | B1 |  |


| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 10 (b) | $\begin{aligned} & \frac{4}{10} \times \frac{4}{10} \text { or } \frac{6}{10} \\ & \times \frac{6}{10} \end{aligned}$ | M1 |  |
|  | $\begin{aligned} & \frac{4}{10} \times \frac{4}{10}+\frac{6}{10} \\ & \times \frac{6}{10} \end{aligned}$ | M1dep |  |
|  | 0.52 | A1 | oe |
| 11 | $\begin{aligned} & \hline 3 x+2 y=2 \text { and } \\ & 3 x+12 y=27 \\ & \text { or } 6 x+4 y=4 \\ & \text { and } x+4 y=9 \\ & \hline \end{aligned}$ | M1 |  |
|  | $x=-1$ | A1 |  |
|  | $y=2.5$ | A1 |  |
| 12 (a) | $(x+5)(x-5)$ | B1 |  |
| 12 (b) | $\begin{aligned} & x^{2}+4 x+4 \text { or } \\ & x^{2}+2 x+1 \end{aligned}$ | M1 | $\begin{aligned} & (x+2+x+1) \\ & (x+2-(x+1)) \end{aligned}$ |
|  | $\begin{aligned} & x^{2}+4 x+4- \\ & \left(x^{2}+2 x+1\right) \end{aligned}$ | M1dep | $(2 x+3)(1)$ |
|  | Shows subtraction of terms clearly | A1 |  |
| 13 (a) | $\begin{aligned} & 12 \times \sin 32= \\ & 6.36(2 \mathrm{dp}) \end{aligned}$ | B1 |  |
| 13 (b) | $\pi \times 6.36 \times 12$ | M1 |  |
|  | [236.6, 240] | A1 |  |
| 14 | 0.92 | B1 |  |
|  | $0.92{ }^{n}$ for $n>3$ | M1 |  |
|  | 9 years | A1 | Accept just over 8 or between 8 and 9 |
| 15 | A C B | B2 | B1 for 1 correct |
| 16 | $4 x^{4} y^{6}$ | B2 | B1 for 2 parts correct |
| 17 (a) | $B$ and D | B1 |  |
| 17 (b) | A and D | B1 |  |
| 18 (a) | 30 and 38 | B2 | B1 each |
| 18 (b) | Works out second difference as 2 | M1 |  |
|  | Subtracts $n^{2}$ from series, ie $5,6,7$, 8, $9 \ldots$ | M1dep |  |
|  | Identifies $n$ +4 as linear sequence | A1 |  |
|  | $n^{2}+n+4$ | A1 |  |


| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 19 | Shows reflected triangle $B$ at $(7,2)$, $(7,4)$ and $(9,4)$ | M1 |  |
|  | Shows reflected triangle $C$ at $(1,4),(3,4)$ and $(3,2)$ | M1dep |  |
|  | Rotation, $180^{\circ}$, about (5, 6) | A2 | A1 for 2 parts. Accept reflection in line $y+x=11$ oe |
| 20 | $\frac{x}{\sin 78}=\frac{11}{\sin 65}$ | M1 |  |
|  | $x=\frac{11 \times \sin 78}{\sin 65}$ | M1dep |  |
|  | [11.87, 11.9] | A1 |  |
| 21 | $14 \div 8$ or 1.75 | M1 |  |
|  | $540 \times$ (their 1.75) $^{3}$ | M1dep |  |
|  | 2890 | A1 |  |
| 22 | $\begin{aligned} & A C=\sqrt{8^{2}+6^{2}} \\ & \text { or } 10 \end{aligned}$ | M1 |  |
|  | $C X=5$ | A1 |  |
|  | $v x=\sqrt{12^{2}-5^{2}}$ <br> or $\sqrt{119}$ or 10.9.. | M1dep |  |
|  | $\begin{aligned} & \text { Angle VCX = } \\ & \sin ^{-1}(10.9 \div 12) \end{aligned}$ | M1dep | Can use cos or tan |
|  | [65, 65.4] | A1 |  |
| 23 (a) | $b=\sqrt[3]{2 a-3}$ | B1 |  |
| 23 (b) | -1 | B1 |  |
| 23 (c) | -1.89 | B2 | B1 for any further iterations or 1.89.... |


| Question | Answer | Mark | Comments |
| :---: | :---: | :---: | :---: |
| 24 (a) | $x^{2}+y^{2}=16$ | B1 |  |
| 24 (b) | Angle $=\tan ^{-1}(2)$ or 63.43.. | M1 |  |
|  | $\begin{array}{\|l\|} \hline \text { (their } 63.43 \div \\ 360) \times 2 \times \pi \\ \times \text { their radius } \\ \hline \end{array}$ | M1dep |  |
|  | [4.36, 4.43] | A1 |  |
| 25 | $\frac{4}{9} x$ | M1 |  |
|  | $\frac{4}{9} x+7$ | M1dep |  |
|  | $\frac{4}{9} x+7=\frac{x+7}{2}$ | M1dep |  |
|  | $\frac{1}{18} x=\frac{7}{2}$ | M1dep |  |
|  | 63 | A1 | T\&I B1 for correct answer |
| 26 (a) | $\frac{x+1}{3}$ | B2 | B1 for numerator of $3(x+1)$ B1 for $\frac{x-1}{3}$ |
| 26 (b) | $3\left(x^{2}+2\right)-1$ | M1 |  |
|  | $3 x^{2}+5$ | A1 |  |
| 27 | $x^{2}+(x+3)^{2}$ | M1 |  |
|  | $\begin{aligned} & x^{2}+x^{2}+6 x+9= \\ & x+12 \end{aligned}$ | A1 |  |
|  | $2 x^{2}+5 x-3=0$ | M1 |  |
|  | $(2 x-1)(x+3)$ | A1 |  |
|  | $\begin{aligned} & \left(\frac{1}{2}, 3 \frac{1}{2}\right) \text { and } \\ & (-3,0) \end{aligned}$ | A1 |  |

