Q1 (1)

**1** The coefficient of $x^2$ in the expansion of $(1-4x)^6$ is 12 times the coefficient of $x^2$ in the expansion of $(2+ax)^5$.

Find the value of the positive constant $a$. [3]

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 1 | $240\left[x^2\right]$ or $80a^2\,[x^2]$ | **B1** | May be seen in an expansion. |
| | $240 = 12 \times 80a^2$ | **M1** | *Their* 240 equated to 12 × *their* $80a^2$ which must contain $a^2$. |
| | 0.5 | **A1** | OE<br>Condone ± 0.5 |
| | | **3** | |

Q2 (2)

**2** The curve $y = x^2$ is transformed to the curve $y = 4(x-3)^2 - 8$.

Describe fully a sequence of transformations that have been combined, making clear the order in which the transformations have been applied. [5]

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 2 | Stretch **factor** 4 in $y$-direction/parallel to the $y$ axis/vertically. | **B1** | Allow use of SF in place of factor.<br>Allow in/on/along the $y$ axis or 'the $x$ axis is invariant.' |
| | Translation<br>$\begin{pmatrix}3\\0\end{pmatrix}$ or 3 parallel to the $x$ axis or in the $x$ direction, allow horizontally.<br>$\begin{pmatrix}0\\-8\end{pmatrix}$ or −8 parallel to the $y$ axis or in the $y$ direction, allow vertically. | **B2** | Condone 'Shift'.<br>These translations can be combined as $\begin{pmatrix}3\\-8\end{pmatrix}$, this counts as 2 elements.<br>Give priority to a correct vector over any incorrect wording.<br>B2 for all 3<br>B1 for 2 out of 3 |
| | Two translations, one in each direction, and a stretch only. | **M1** | Condone inaccurate terminology, such as up, down, left and right, if the intention is clear. |
| | Correct order of operations. The stretch which must be in the in the $y$ direction must come before the translation in the $y$ direction. | **A1** | Condone inaccurate terminology if the intention is clear but numerical values must be correct. |

Q3 (3)

**3** **(a)** Show that the equation $\dfrac{7\tan\theta}{\cos\theta} + 12 = 0$ can be expressed as

$$12\sin^2\theta - 7\sin\theta - 12 = 0.$$ [3]

**(b)** Hence solve the equation $\dfrac{7\tan\theta}{\cos\theta} + 12 = 0$ for $0^\circ \leqslant \theta \leqslant 360^\circ$. [3]

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 3(a) | $7\frac{\sin\theta}{\cos\theta} \div \cos\theta + 12[=0]$ $\left[\text{leading to } 7\frac{\sin\theta}{\cos\theta} + 12\cos\theta = 0\right]$ | **M1*** | OE<br>Use of $\tan\theta = \frac{\sin\theta}{\cos\theta}$. |
| | $7\sin\theta + 12(1-\sin^2\theta)[=0]$ | **DM1** | Use of $s^2 + c^2 = 1$. |
| | $\Rightarrow 12\sin^2\theta - 7\sin\theta - 12 = 0$ | **A1** | AG, WWW<br>Condone use of s, c and t and/or omission of $\theta$ throughout working but the A1 is for cao. |
| | | **3** | |
| 3(b) | $[12\sin^2\theta - 7\sin\theta - 12 = 0 \text{ leading to}](4\sin\theta + 3)(3\sin\theta - 4)$ | **M1** | |
| | $\sin\theta = -\frac{3}{4}$ $\left[\text{or } \frac{4}{3}\right]$ | **B1** | OE, WWW<br>Can be implied by a correct value for $\sin^{-1}\left(-\frac{3}{4}\right)$<br>e.g. $-48.6°$. |
| | $[\theta =] 228.6°, 311.4°$ | **B1** | AWRT, WWW<br>No others in the range $0° \leq \theta \leq 360°$.<br>Ignore any answers outside this range.<br>Condone 229°, 311°. |
| | | **3** | |

## Q4 (1)

**1** The coefficient of $x^2$ in the expansion of $(1-4x)^6$ is 12 times the coefficient of $x^2$ in the expansion of $(2+ax)^5$.

Find the value of the positive constant $a$. [3]

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 1 | $240[x^2]$ or $80a^2[x^2]$ | **B1** | May be seen in an expansion. |
| | $240 = 12 \times 80a^2$ | **M1** | *Their* 240 equated to 12 × *their* $80a^2$ which must contain $a^2$. |
| | 0.5 | **A1** | OE<br>Condone ± 0.5 |
| | | **3** | |

## Q5 (2)

**2** The curve $y = x^2$ is transformed to the curve $y = 4(x-3)^2 - 8$.

Describe fully a sequence of transformations that have been combined, making clear the order in which the transformations have been applied. [5]

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 2 | Stretch **factor** 4 in *y*-direction/parallel to the *y* axis/vertically. | **B1** | Allow use of SF in place of factor.<br>Allow in/on/along the *y* axis or 'the *x* axis is invariant.' |
| | Translation<br>$\begin{pmatrix}3\\0\end{pmatrix}$ or 3 parallel to the *x* axis or in the *x* direction, allow horizontally.<br>$\begin{pmatrix}0\\-8\end{pmatrix}$ or −8 parallel to the *y* axis or in the *y* direction, allow vertically. | **B2** | Condone 'Shift'.<br>These translations can be combined as $\begin{pmatrix}3\\-8\end{pmatrix}$, this counts as 2 elements.<br>Give priority to a correct vector over any incorrect wording.<br>B2 for all 3<br>B1 for 2 out of 3 |
| | Two translations, one in each direction, and a stretch only. | **M1** | Condone inaccurate terminology, such as up, down, left and right, if the intention is clear. |
| | Correct order of operations. The stretch which must be in the in the *y* direction must come before the translation in the *y* direction. | **A1** | Condone inaccurate terminology if the intention is clear but numerical values must be correct. |

Q6 (1)

**1** Which unit is **not** an SI base unit?

**A** A **B** kg **C** C **D** s

$$F = \rho g V$$

$$f_o = \frac{f_s v}{v \pm v_s}$$

$$I = Anvq$$