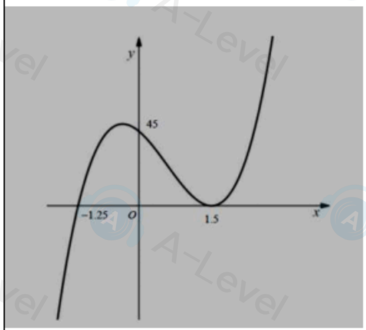
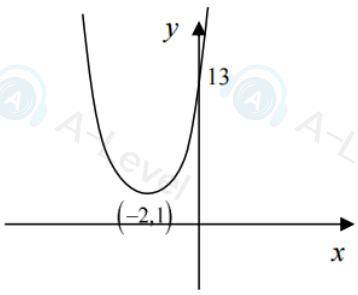
| Question Number | Scheme | Marks |
|---|---|---|
| **3(a)** | $\left(2\sqrt{2}\right)^2 = p^2+q^2-2pq\cos 60°$ oe | M1 |
| | $p^2+q^2-pq=8$ * | A1* |
| | | **(2)** |
| **(b)** | $q=p+2 \Rightarrow 8=p^2+("p+2")^2-p("p+2")$ | M1 |
| | $p^2+2p-4=0$ or $q^2-2q-4=0$ | A1 |
| | $p=\dfrac{-2\pm\sqrt{2^2-4\times1\times(-4)}}{2}$ or $q=\dfrac{2\pm\sqrt{(-2)^2-4\times1\times(-4)}}{2}$ | M1 |
| | $p=-1+\sqrt{5}$ or $q=1+\sqrt{5}$ | B1 (A1 on EPEN) |
| | $p=-1+\sqrt{5}$ and $q=1+\sqrt{5}$ only | A1cso |
| | | **(5)** |
| **(c)** | $\text{Area}=\dfrac{1}{2}\times("-1+\sqrt{5}")("1+\sqrt{5}")\times\sin 60°$ | M1 |
| | $\text{Area}=\sqrt{3}\ \ (\text{m}^2)$ | A1 |
| | | **(2)** |
| **Alt(a)** | Forming a line *BX* which is perpendicular to *AC* where *X* is on the line *AC*. | |
| | $AX = p\cos 60 = \dfrac{p}{2}$ | |
| | $BX=\sqrt{p^2-\left(\dfrac{p}{2}\right)^2}=\dfrac{\sqrt{3}}{2}p$ or $BX = p\sin 60$ | |
| | $\left(\dfrac{\sqrt{3}}{2}p\right)^2+\left(q-\dfrac{p}{2}\right)^2=\left(2\sqrt{2}\right)^2$ or $(p\sin 60)^2+\left(q-\dfrac{p}{2}\right)^2=\left(2\sqrt{2}\right)^2$ | M1 |
| | $\dfrac{3p^2}{4}+q^2-pq+\dfrac{p^2}{4}=8$ | |
| | $p^2+q^2-pq=8$ * | A1* |
| | | **(9 marks)** |

| Question Number | Scheme | Marks |
|---|---|---|
| **8 (a)** | $f'(x) = 2(x-3)(3x+2) = 6x^2 - 14x - 12$ | B1 |
| | $f(x) = 2x^3 - 7x^2 - 12x + k$ | M1, A1 |
| | Uses $P(4, 13) \Rightarrow 13 = 2\times64 - 7\times16 - 12\times4 + k \Rightarrow k = ...$ | M1 |
| | $(f(x)) = 2x^3 - 7x^2 - 12x + 45$ | A1 |
| | | **(5)** |
| **(b)** | $2x^3 - 7x^2 - 12x + 45 \equiv (x^2 - 6x + 9)(px + q) \Rightarrow p = "2"$ or $q = \frac{"45"}{9}$ | B1 ft |
| | States either $2x^3 - 7x^2 - 12x + 45 \equiv (x-3)^2(2x+5)$ or $p = 2$ & $q = 5$ following a fully correct (a) or correct but incomplete part (a) (See notes) | B1 |
| | | **(2)** |
| **(c)** |  + ve cubic curve | B1 |
| | "Correct" $y$ intercept for their part (b) equation. So $9q$ or "45" | B1ft |
| | Turning point at $(1.5, 0)$ | B1 |
| | $x$ intercept at $(-1.25, 0)$ | B1 |
| | | **(4)** |
| | | **(11 marks)** |

| | | |
|---|---|---|
| **(b)** | $(f(x) =) \int \frac{1}{4}x^3 - 8x^{-\frac{1}{2}}\,dx = \frac{1}{4}\frac{x^4}{4} - \frac{8x^{\frac{1}{2}}}{\frac{1}{2}} (+c)$ | **M1** **A1** |
| | $f(4) = 12 \Rightarrow 16 - 32 + c = 12 \Rightarrow c = ...(28)$ | **dM1** **A1** |
| | So $(f(x) =) \frac{x^4}{16} - 16\sqrt{x} + "28"$ | **A1ft** |
| | | **(5)** |

| Question | Scheme | Marks |
|---|---|---|
| **3(a)** | $a = 3$ | **B1** |
| | $b = \pm 2$ | **M1** |
| | $3x^2 + 12x + 13 = 3(x+2)^2 + 1$ or $a = 3,\ b = 2,\ c = 1$ | **A1** |
| | | **(3)** |
| **(b)** |  Correct U shape with minimum in second quadrant | **B1** |
| | Intercept 13 on $y$-axis. | **B1** |
| | Vertex at $(-2, 1)$ | **B1ft** |
| | | **(3)** |
| | | **(6 marks)** |