Question Number	Scheme	Marks
7	Assume that $\sqrt{7}$ is rational so that $\sqrt{7}=\frac{a}{b}\Rightarrow 7=\frac{a^2}{b^2}$ (where a and b have no factors in common)	M1
	$7=\frac{a^2}{b^2}\Rightarrow 7b^2=a^2$ So a^2 is a multiple of 7 which means a is a multiple of 7	A1
	$a=7k\Rightarrow 7b^2=49k^2\Rightarrow b^2=7k^2$	M1
	So b^2 is a multiple of 7 which means b is a multiple of 7. As a and b are both multiples of 7, this contradicts the fact that a and b have no factors in common. Hence $\sqrt{7}$ must be irrational.	A1
		(4)
		Total 4

Any variables may be used

M1: Starts the proof by contradicting the given statement and squares both sides.

Condone the omission of the statement about common factors here.

As a minimum allow "assume $\sqrt{7}=\frac{a}{b}\Rightarrow 7=\frac{a^2}{b^2}$" or similar "let $\sqrt{7}=\frac{p}{q}\Rightarrow p^2=7q^2$"

A1: Reaches for example $7b^2=a^2$ and deduces that a^2 is a multiple of 7 which means a is a multiple of 7
Condone these being the "wrong way around" as long as they state both a and a^2 are multiples of 7
Look for

- $7b^2=a^2$
- states a is a multiple of 7 (which may be implied by setting $a=7k$ for example)
- states a^2 is a multiple of 7

M1: Sets $a=7k$ and proceeds to $b^2=7k^2$

A1: Fully Correct proof. This must include

- an initial statement that included that a and b had no common factors. Allow equivalent statements such as $\frac{a}{b}$ is a fraction in simplest form or co-prime, relatively prime, mutually prime
- the statements and conclusions the correct way around.
  E.g. a^2 is a multiple of 7 which means a is a multiple of 7 (not the other way around)
  and b^2 is a multiple of 7 which means b is a multiple of 7 (not the other way around)
- a minimal conclusion

Be tolerant of slight issues with terminology/language used as this may not be the students first language.

Question Number	Scheme	Marks
8(a)	$x = 2$	B1
		(1)
(b)	$(2.5, 1.5)$	B1
		(1)
(c)	$\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{1+\frac{1}{t^2}}{1-\frac{1}{t^2}}$	M1
	$t = 2 \Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{5}{3} \Rightarrow y - 1.5 = -\dfrac{3}{5}(x - 2.5)$	dM1
	$3x + 5y = 15$*	A1*
		(3)
(d)	l crosses x-axis at $x = 5$	B1
	$\dfrac{1}{3}\pi \times 1.5^2 (5 - 2.5) \left(= \dfrac{15}{8}\pi\right)$	M1
	$V = \pi \int y^2 \mathrm{d}x = \pi \int y^2 \dfrac{\mathrm{d}x}{\mathrm{d}t}\, \mathrm{d}t = \pi \int \left(t - \dfrac{1}{t}\right)^2 \left(1 - \dfrac{1}{t^2}\right) \mathrm{d}t$	M1
	$\pi \int \left(t^2 - 2 + \dfrac{1}{t^2}\right)\left(1 - \dfrac{1}{t^2}\right) \mathrm{d}t = \pi \int \left(t^2 + \dfrac{3}{t^2} - \dfrac{1}{t^4} - 3\right) \mathrm{d}t = \ldots$	M1
	$\pi \left[\dfrac{t^3}{3} - \dfrac{3}{t} + \dfrac{1}{3t^3} - 3t\right]$	A1
	$\pi \left[\dfrac{t^3}{3} - \dfrac{3}{t} + \dfrac{1}{3t^3} - 3t\right]_1^2 = \pi \left(\left(\dfrac{8}{3} - \dfrac{3}{2} + \dfrac{1}{24} - 6\right) - \left(\dfrac{1}{3} - 3 + \dfrac{1}{3} - 3\right)\right)$	M1
	$V = \dfrac{13}{24}\pi + \dfrac{15}{8}\pi = \dfrac{29}{12}\pi$ Cao	A1
		(7)
		Total 12

(a)
B1: Correct value. Just look for 2 and condone $Q = 2$

(b)
B1: Correct coordinates. Allow these to be given separately $x = 2.5, \quad y = 1.5$

(c)

M1: Attempts to differentiate both parameters and use $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\mathrm{d}y}{\mathrm{d}t} \div \dfrac{\mathrm{d}x}{\mathrm{d}t}$ to achieve $\dfrac{1 \pm \frac{1}{t^2}}{1 \pm \frac{1}{t^2}}$ or equivalent via quotient rule

dM1: Uses $t = 2$ in their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and uses the negative reciprocal gradient with their point P to form equation of normal.It is dependent upon the previous M

A1*: Obtains the printed answer with no errors and sufficient working shown.
What is shown in the MS is sufficient