Question Number	Scheme	Marks
1.	$\int\left(3x+\frac{2}{x}\right)^2 \mathrm{d}x$	
	$\left(3x+\frac{2}{x}\right)^2 = 9x^2+12+4x^{-2}$	M1 A1
	$\int\left(3x+\frac{2}{x}\right)^2 \mathrm{d}x = \int\left(9x^2+12+4x^{-2}\right)\mathrm{d}x = 3x^3+12x-\frac{4}{x}+c$	M1 A1 A1
		(5 marks)

Notes

M1: Attempts to multiply out. Requires a minimum of $...x^2+\frac{...}{x^2}$ oe e.g. $...x^2+...x^{-2}$.

A1: For $9x^2+12+\frac{4}{x^2}$ oe e.g. $9x^2+12+4x^{-2}$ but allow this unsimplified with the terms uncollected e.g. $9x^2+6+6+\frac{4}{x^2}$ but **not** e.g. $9x^2+\frac{6x}{x}+\frac{6x}{x}+\frac{4}{x^2}$ i.e. the middle terms need to become 6's

M1: For an attempt to integrate a term in x following an attempt to expand.
It is for either $...x^2 \to ...x^3$ or $...x^{-2} \to ...x^{-1}$ but allow the index to be unprocessed, e.g. $...x^2 \to ...x^{2+1}$ or $...x^{-2} \to ...x^{-2+1}$
Do **not** allow for just e.g. $12 \to 12x$.
Condone poor notation e.g. missing integral signs and just look for the integrated terms.

A1: For at least 2 correct and simplified terms.
It is for any 2 of $3x^3$, $12x$ or $-\frac{4}{x}\left(\text{or } -4x^{-1}\right)$.
Condone $+\frac{4x^{-1}}{-1}$ for **this** mark.

A1: $3x^3+12x-\frac{4}{x}+c$ or exact simplified equivalent e.g. $3x^3+12x-4x^{-1}+c$ including the $+c$
Do **not** condone $+\frac{4x^{-1}}{-1}$ for this mark.
Ignore any spurious notation e.g. $\int\left(9x^2+12+4x^{-2}\right)\mathrm{d}x = \int 3x^3+12x-\frac{4}{x}+c$
Apply isw once a correct answer is seen.

<u>Attempts to combine the terms inside the brackets first:</u>

e.g. $\left(3x+\frac{2}{x}\right)^2 = \left(\frac{3x^2+2}{x}\right)^2 = \frac{9x^4+12x^2+4}{x^2} = 9x^2+12+\frac{4}{x^2}$

M1: Combines terms to obtain $\frac{...x^2+...}{x}$, squares numerator and denominator and writes as separate terms. Requires a minimum of $...x^2+\frac{...}{x^2}$ oe e.g. $...x^2+...x^{-2}$.
The rest of the marks can be applied as above.

Question Number	Scheme	Marks
2(a)	Gradient of l_2 is $\frac{1}{3}$ **or** y coordinate of P is -2	B1
	$y+2=\frac{1}{3}(x-4)$ or e.g. $\frac{y+2}{x-4}=\frac{1}{3}$ or e.g. $y=\frac{1}{3}x+c \Rightarrow -2=\frac{1}{3}\times 4+c \Rightarrow c=...\left(-\frac{10}{3}\right)$	M1
	$x-3y-10=0$	A1
		(3)

Notes

B1: States or uses gradient l_2 is $\frac{1}{3}$ or y coordinate of P is -2

M1: Correct attempt at the equation of the normal using $x = 4$, a gradient of $\frac{1}{3}$ and a value of y which has come from an attempt to substitute $x = 4$ into $y = 10 – 3x$ **with the values correctly placed**. If they use $y = mx + c$, they must reach at least $c = \ldots$

A1: For $x-3y-10=0$ or any integer multiple of this equation in the required form.
Allow $1x-3y-10=0$ and allow e.g. $0=x-3y-10$ and allow the terms in any order.

(b)	States or uses coordinates of N as $\left(0,-\frac{10}{3}\right)$	B1ft
	Area of triangle $MPN=\frac{1}{2}\times\left(10+\frac{10}{3}\right)\times 4$ or e.g. $\frac{1}{2}MP\times NP=\frac{1}{2}\sqrt{4^2+12^2}\times\sqrt{4^2+\left(\frac{10}{3}-2\right)^2}\left(=\frac{1}{2}\times 4\sqrt{10}\times\frac{4\sqrt{10}}{3}\right)$ or e.g. $\frac{1}{2}\begin{vmatrix}0 & 0 & 4 & 0\\ 10 & -\frac{10}{3} & -2 & 10\end{vmatrix}=\frac{1}{2}\left(4\times 10-4\times-\frac{10}{3}\right)$ which may be seen as e.g. $\frac{1}{2}\times 4\left(10-\left(-\frac{10}{3}\right)\right)+\frac{1}{2}\times 0\times\left(-\frac{10}{3}-(-2)\right)+\frac{1}{2}\times 0\times(-2-10)$ or e.g. $\frac{1}{2}\times 12\times 4+\frac{1}{2}\times\frac{4}{3}\times 4$ or e.g.	M1

	$\frac{1}{2}MN\times NP\sin MNP=\frac{1}{2}\times\frac{40}{3}\times\sqrt{4^2+\left(\frac{10}{3}-2\right)^2}\sin\left\{\cos^{-1}\left(\frac{\left(\frac{4\sqrt{10}}{3}\right)^2+\left(\frac{40}{3}\right)^2-\left(4\sqrt{10}\right)^2}{2\times\frac{4\sqrt{10}}{3}\times\frac{40}{3}}\right)\right\}$	
	$=\frac{80}{3}$	A1
		(3)

Notes

(b)

B1ft: States or uses coordinates of N as $\left(0,-\frac{10}{3}\right)$. Follow through on their $-\frac{c}{b}$ from part (a).
May be implied and may be seen on a diagram.

M1: Attempts area of triangle MPN using a **fully correct method** for their values.
Note that there are many different ways to find the required area so you may need to check their working carefully.
In all cases, the method must be fully correct for their values including correct use of e.g. Pythagoras or the cosine rule if they are used.
Note that *M* and *N* must both be on the *y*-axis so if e.g. they substitute $y = 0$ into either straight line equation and treat the resulting x values as y values, this scores M0

A1: For $\frac{80}{3}$ or **exact** equivalent e.g. $26\frac{2}{3}$ or $26.\dot{6}$ but not e.g. 26.6 or 26.7 unless the correct exact value is seen previously then apply isw. Allow recovery from inexact intermediate working provided the method is correct and the correct exact answer is obtained.
Ignore any reference to units.

		(6 marks)

Diagram for 2(b):

