Question Number	Scheme	Marks
3	$8y\dfrac{\mathrm{d}y}{\mathrm{d}x} = x\mathrm{e}^{-y^2} \rightarrow \int 8y\mathrm{e}^{y^2}\,\mathrm{d}y = \int x\,\mathrm{d}x$	B1
	$4\mathrm{e}^{y^2} = \dfrac{x^2}{2}\ (+c)$	M1A1
	$4 = \dfrac{5^2}{2} + c \Rightarrow c = ...$	**d**M1
	$y^2 = \ln\left(\dfrac{x^2-17}{8}\right)$	A1
		(5 marks)

B1: Separates the variables correctly with some indication of integration.

Allow any correct separation e.g. $8\int \dfrac{y}{\mathrm{e}^{-y^2}}\mathrm{d}y = \int x\,\mathrm{d}x$, $\int y\mathrm{e}^{y^2}\mathrm{d}y = \dfrac{1}{8}\int x\,\mathrm{d}x$, $\int \dfrac{y}{\mathrm{e}^{-y^2}}\mathrm{d}y = \int \dfrac{x}{8}\,\mathrm{d}x$

Award for any of the above with at least one integral sign. If there are no integral signs then there must be an attempt to integrate at least one side.

Condone the omission of dx or dy as long as the intention is clear.

M1: For integrating $...y\mathrm{e}^{y^2}$ correctly to obtain $...\mathrm{e}^{y^2}$

May be implied by a substitution e.g. $u = y^2 \Rightarrow \int 8y\mathrm{e}^{y^2}\mathrm{d}y = \int \dfrac{8y}{2y}\mathrm{e}^u\mathrm{d}u = 4\mathrm{e}^u\ (+c)$

Incorrect attempts to integrate $...y\mathrm{e}^{y^2}$ e.g. by parts will generally score no more marks.

A1: Fully correct equation with or without a constant of integration e.g.

$4\mathrm{e}^{y^2} = \dfrac{x^2}{2}\ (+c)$, $8\mathrm{e}^{y^2} = x^2\ (+c)$, $\mathrm{e}^{y^2} = \dfrac{x^2}{8}\ (+c)$ etc.

dM1: **Depends on the first method mark.**

Substitutes in $y = 0$ and $x = 5$ and proceeds to find a value for c.

A1: Correct equation: $y^2 = \ln\left(\dfrac{x^2-17}{8}\right)$ oe e.g.

$y^2 = \ln\left(\dfrac{x^2}{8} - \dfrac{17}{8}\right)$, $y^2 = \ln\dfrac{1}{8}\left(x^2-17\right)$, $y^2 = \ln\left(x^2-17\right) - \ln 8$ etc.

Brackets must be present if necessary e.g. in $y^2 = \ln\left(\dfrac{x^2}{8} - \dfrac{17}{8}\right)$ but not in e.g. $y^2 = \ln\dfrac{x^2-17}{8}$

Apply isw once the correct answer is seen.

Question Number	Scheme	Marks
4(a)	$4^{\frac{1}{2}}\left(1+\frac{5}{4}x\right)^{\frac{1}{2}}$	B1
	$\left(1+\frac{5}{4}x\right)^{\frac{1}{2}}=1+\left(\frac{1}{2}\right)\left(\frac{5}{4}x\right)+\frac{\left(\frac{1}{2}\right)\left(-\frac{1}{2}\right)}{2!}\left(\frac{5}{4}x\right)^2+\frac{\left(\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)}{3!}\left(\frac{5}{4}x\right)^3+...$	M1A1
	$4^{\frac{1}{2}}\left(1+\frac{5}{4}x\right)^{\frac{1}{2}}=2+\frac{5}{4}x-\frac{25}{64}x^2+\frac{125}{512}x^3$	A1A1
		(5)

(a)

B1: Obtains $4^{\frac{1}{2}}\left(1+...x\right)^{\frac{1}{2}}$ or e.g. $2\left(1+...x\right)^{\frac{1}{2}}$ or e.g. $\sqrt{4}\left(1+...x\right)^{\frac{1}{2}}$ which may be implied by subsequent work.

M1: Attempts the binomial expansion of $\left(1+kx\right)^{\frac{1}{2}}$ to get the **third** or **fourth** term **unsimplified** with an acceptable structure.

The correct binomial coefficient must be combined with x^2 or x^3 which may be unsimplified.

Look for $\frac{\frac{1}{2}\left(\frac{1}{2}-1\right)}{2!}...x^2$ or $\frac{\frac{1}{2}\left(\frac{1}{2}-1\right)\left(\frac{1}{2}-2\right)}{3!}...x^3$ o.e. (you do not need to be concerned with their $\frac{5}{4}$ which may be 1 or e.g. if they have a negative sign in front of the whole term)

Do not allow notation such as $\left(\frac{1}{2}\right)$, $\left(\frac{1}{2}\right)$ or ${}^{\frac{1}{2}}C_2$, ${}^{\frac{1}{2}}C_3$ unless interpreted correctly in further work.

May be implied by correct coefficients with x^2 or x^3

A1: Correct third or fourth term unsimplified for $\left(1+\frac{5}{4}x\right)^{\frac{1}{2}}$ e.g. with the correct sign.

$$\frac{\left(\frac{1}{2}\right)\left(-\frac{1}{2}\right)}{2!}\left(\frac{5}{4}x\right)^2 \text{ or } \frac{\left(\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)}{3!}\left(\frac{5}{4}x\right)^3$$

Do not condone missing brackets e.g. $\frac{5}{4}x^2$ or $\frac{5}{4}x^3$ unless they are implied by subsequent work.

A1: Two correct simplified terms of $\frac{5}{4}x$, $-\frac{25}{64}x^2$, $\frac{125}{512}x^3$ which may be listed.

Condone $\frac{5}{4}x^1$ for this mark.

Condone coefficients given as decimals e.g. $1.25x$, $-0.390625x^2$, $0.24414...x^3$

A1: $2+\frac{5}{4}x-\frac{25}{64}x^2+\frac{125}{512}x^3$ which may be listed and isw once a correct answer is seen.

Condone coefficients given as decimals e.g. $2+1.25x-0.390625x^2+0.244140625x^3$

Do not condone $\frac{5}{4}x^1$ for this mark and do not condone $...+-\frac{25}{64}x^2+...$

Note that if their "$4^{\frac{1}{2}}$" is incorrect they can score a maximum of B0M1A1A0A0

(a) Alternative by direct expansion:

$$(4+5x)^{\frac{1}{2}} = 4^{\frac{1}{2}} + \left(\frac{1}{2}\right)4^{-\frac{1}{2}}(5x) + \frac{\left(\frac{1}{2}\right)\left(\frac{1}{2}-1\right)}{2}4^{-\frac{3}{2}}(5x)^2 + \frac{\left(\frac{1}{2}\right)\left(\frac{1}{2}-1\right)\left(\frac{1}{2}-2\right)}{3!}4^{-\frac{5}{2}}(5x)^3 + ...$$

B1: For $4^{\frac{1}{2}} + ...$ or $\sqrt{4} + ...$ or $2 + ...$

M1: Attempts the binomial expansion of $(4+5x)^{\frac{1}{2}}$ to get the **third** or **fourth** term **unsimplified** with an acceptable structure.

The correct binomial coefficient must be combined with x^2 or x^3 and the correct power of 4 which may be unsimplified.

Look for $\frac{\frac{1}{2}\left(\frac{1}{2}-1\right)}{2!}4^{-\frac{3}{2}}...x^2$ or $\frac{\left(\frac{1}{2}\right)\left(\frac{1}{2}-1\right)\left(\frac{1}{2}-2\right)}{3!}4^{-\frac{5}{2}}...x^3$ o.e. (you do not need to be concerned with their 5 which may be 1 or e.g. if they have a negative sign in front of the whole term)

Do not allow notation such as $\binom{\frac{1}{2}}{2}$, $\binom{\frac{1}{2}}{3}$ or ${}^{\frac{1}{2}}C_2$, ${}^{\frac{1}{2}}C_3$ unless interpreted correctly in further work.

A1: Correct third or fourth term unsimplified e.g.

$\frac{\left(\frac{1}{2}\right)\left(\frac{1}{2}-1\right)}{2}4^{-\frac{3}{2}}(5x)^2$ or $\frac{\left(\frac{1}{2}\right)\left(\frac{1}{2}-1\right)\left(\frac{1}{2}-2\right)}{3!}4^{-\frac{5}{2}}(5x)^3$

Do not condone missing brackets e.g. $5x^2$ or $5x^3$ unless they are implied by subsequent work.

A1: Two correct simplified terms of $\frac{5}{4}x$, $-\frac{25}{64}x^2$, $\frac{125}{512}x^3$ which may be listed.

Condone $\frac{5}{4}x^1$ for this mark.

Condone coefficients given as decimals e.g. $1.25x$, $-0.390625x^2$, $0.24414...x^3$

A1: $2+\frac{5}{4}x-\frac{25}{64}x^2+\frac{125}{512}x^3$ which may be listed and isw once a correct answer is seen.

Condone coefficients given as decimals e.g. $2+1.25x-0.390625x^2+0.244140625x^3$

Do not condone $\frac{5}{4}x^1$ for this mark and do not condone $...+-\frac{25}{64}x^2+...$

Any attempts to use a Maclaurin series should be sent to review.

(b)	$\lvert x\rvert$ „ $\frac{4}{5}$	B1
		(1)
(c)(i)	$2-\frac{5}{4}x-\frac{25}{64}x^2-\frac{125}{512}x^3$	B1ft
		(1)
(c)(ii)	$"2"+"2"+"-\frac{25}{64}"x^2+"-\frac{25}{64}"x^2=4-\frac{25}{32}x^2$	M1A1
		(2)
		(9 marks)

(b)

B1: $\lvert x\rvert$ „ $\frac{4}{5}$ or $\lvert x\rvert<\frac{4}{5}$ or accept strict or non-strict inequalities at either end e.g.

$-\frac{4}{5}<x<\frac{4}{5}$, $-\frac{4}{5}$ „ $x<\frac{4}{5}$, $-\frac{4}{5}<x$ „ $\frac{4}{5}$, $\frac{4}{5}>x>-\frac{4}{5}$, $x>-\frac{4}{5}$ and $x<\frac{4}{5}$

or interval notation e.g. $\left(-\frac{4}{5},\frac{4}{5}\right)$, $\left[-\frac{4}{5},\frac{4}{5}\right]$, $\left[-\frac{4}{5},\frac{4}{5}\right)$, $\left(-\frac{4}{5},\frac{4}{5}\right]$

(c)(i)

B1ft: $2-\frac{5}{4}x-\frac{25}{64}x^2-\frac{125}{512}x^3$ (follow through their (a))

For their $A+Bx+Cx^2+Dx^3$ in part (a) they must obtain $A-Bx+Cx^2-Dx^3$ where *A, B, C* and *D* are non-zero for this mark even if they make a re-start.

(c)(ii)

M1: Adds their $A+Bx+Cx^2+Dx^3$ from part (a) to $A-Bx+Cx^2-Dx^3$ to give $a+bx^2$ or obtains values for *a* and *b*.
May be implied by their answer/values if no incorrect working is seen.

A1: Cao and **cso** $4-\frac{25}{32}x^2$ o.e. e.g. $4-\frac{50}{64}x^2$ Allow $4+-\frac{25}{32}x^2$

This must follow fully correct work in (a) and (c).
Apply isw once the correct answer is seen.