TESTING WHETHER OR NOT TWO GRAPHS ARE JOINED SMOOTHLY.
Two graphs can be joined smoothly if the gradient of the graph on the left is equal to the gradient of the graph on the right at the point where they meet.

## MODEL EXAMPLE:



At $x=1$, both equations give the same $y$ value $y=0$ so the graphs do meet.
The gradient of the left hand curve is $\boldsymbol{y}^{\prime}=2 \boldsymbol{x}$ and at $x=1$ the gradient is $y^{\prime}=2 \times 1=2$
The gradient of the right hand line is $\boldsymbol{y}^{\prime}=\mathbf{1}$
$\left\{\begin{array}{l}\text { Left hand gradient }=2 \\ \text { Right hand gradient }=1\end{array}\right.$
Conclusion: THESE GRAPHS ARE NOT SMOOTHLY JOINED at $\boldsymbol{x}=\boldsymbol{1}$
2. Test as to whether or not these graphs are smoothly joined at $\boldsymbol{x}=2$.
SHOW CLEAR REASONING.

3. Test as to whether or not these graphs are smoothly joined at $\boldsymbol{x}=\mathbf{2}$.

4. Test as to whether or not these graphs are smoothly joined at $\boldsymbol{x}=\boldsymbol{1}$ SHOW CLEAR REASONING.


## MODEL EXAMPLE:

1. $y=x^{2}-1$ for $x \leq 1$


At $x=1$, both equations give the same $y$ value $y=0$ so the graphs do meet.
The gradient of the left hand curve is $\boldsymbol{y}^{\prime}=2 \boldsymbol{x}$ and at $\boldsymbol{x}=1$ the gradient is $\boldsymbol{y}^{\prime}=2 \times 1=2$
The gradient of the right hand line is $\boldsymbol{y}^{\prime}=\mathbf{1}$

$$
\left\{\begin{array}{l}
\text { Left hand gradient }=2 \\
\text { Right hand gradient }=1
\end{array}\right.
$$

Conclusion: THESE GRAPHS ARE NOT

$$
\text { SMOOTHLY JOINED at } \boldsymbol{x}=\boldsymbol{1}
$$

2. Test as to whether or not these graphs are smoothly joined at $\boldsymbol{x}=2$.
SHOW CLEAR REASONING.


The gradient of the left hand curve is $\boldsymbol{y}^{\prime}=2 \boldsymbol{x}$ and at $x=2$ the gradient is $y^{\prime}=2 \times 2=4$
The gradient of the right hand line is $\boldsymbol{y}^{\prime}=\boldsymbol{4}$

$$
\left\{\begin{array}{l}
\text { Left hand gradient }=4 \\
\text { Right hand gradient }=4
\end{array}\right.
$$

Conclusion: THESE GRAPHS ARE

$$
\text { SMOOTHLY JOINED at } \boldsymbol{x}=\mathbf{2}
$$

3. Test as to whether or not these graphs are smoothly joined at $\boldsymbol{x}=2$.


The gradient of the left hand curve is $\boldsymbol{y}^{\prime}=2 \boldsymbol{x}$ and at $x=2$ the gradient is $y^{\prime}=2 \times 2=4$
The gradient of the right hand curve is
$y^{\prime}=-2 x+8=4$ at $x=2$
$\left\{\begin{array}{l}\text { Left hand gradient }=4 \\ \text { Right hand gradient }=4\end{array}\right.$
Conclusion: THESE GRAPHS ARE
SMOOTHLY JOINED at $\boldsymbol{x}=\mathbf{2}$
4. Test as to whether or not these graphs are smoothly joined at $\boldsymbol{x}=\boldsymbol{1}$
SHOW CLEAR REASONING.


The gradient of the left hand curve is $\boldsymbol{y}^{\prime}=-2 \boldsymbol{x}$ and at $\boldsymbol{x}=\boldsymbol{1}$ the gradient is $\boldsymbol{y}^{\prime}=-2 \times 1=-2$ The gradient of the right hand curve is $y^{\prime}=2 x-4=-2$ at $x=1$
$\left\{\begin{array}{l}\text { Left hand gradient }=-2 \\ \text { Right hand gradient }=-2\end{array}\right.$
Conclusion: THESE GRAPHS ARE

$$
\text { SMOOTHLY JOINED at } \boldsymbol{x}=\boldsymbol{1}
$$

