

Maths Stationary Points 2ii

Stationary Points 2ii



Find the coordinates of the stationary points on the curve $y=x^3-3x^2+4$. Enter the x and y coordinates of the stationary point with the greatest x coordinate.
Enter the x -coordinate:
The following symbols may be useful: x
Enter the y -coordinate:
The following symbols may be useful: y

Part B Stationary point

Determine whether the stationary point whose coordinates you entered is a maximum point or a minimum	n
point.	

Inconclusive
Minimum
Maximum

${\bf Part \ C} \qquad {\bf Range \ of} \ x$

What form d then find a a	oes your answer take? Choose from the list below, where a and b are constants and $a < b$, and nd/or b .
x < a	a
$x \leq c$	\mathbf{a}
x > 0	a
$x \geq \alpha$	a
\bigcirc $a < a$	x < b
\bigcirc $a \leq a$	$x \leq b$
x < c	$a ext{ or } x > b$
$x \leq c$	$a ext{ or } x \geq b$
Write down t	the value of a .
	the value of b (or if your chosen form has no b , write "n").
The following symbo	Is may be useful: n

For which range of values of x does $x^3 - 3x^2 + 4$ decrease as x increases?

Used with permission from UCLES, A level, January 2006, Paper 4721, Question 6

Home Maths Calculus Differentiation Powers using Chain Rule 3

Powers using Chain Rule 3

Part A Stationary point of $y = (2-3x)^4 + 4$

Find the coordinates and nature of the stationary point of the function $y=(2-3x)^4+4$.

Find the x coordinate of the stationary point of the function $y = (2 - 3x)^4 + 4$.

The following symbols may be useful: x

Find the y coordinate of the stationary point of the function $y = (2 - 3x)^4 + 4$.

The following symbols may be useful: y

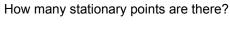
By considering the behaviour of the function when x is very large and positive and also when it is very large and negative deduce the nature of the stationary point of the function $y = (2 - 3x)^4 + 4$.

Minimum

Maximum

Part B Stationary points of $q=4(2p-1)^3-3(2p-1)^4$ Consider the function $q=4(2p-1)^3-3(2p-1)^4$.

Find the stationary points of the function. How many are there? The stationary point with the lowest value of p is at (p_1, q_1) and the stationary point with the second lowest value of p is at (p_2, q_2) . Find the values of p and p at p and p at p and p and p at p a





$$\bigcirc$$
 0

$$\bigcirc$$
 2

Find p_1 , the p coordinate of the stationary point with the lowest value of p.

The following symbols may be useful: p_1 , q_1

Find p_2 , the p coordinate of the stationary point with the second lowest value of p.

The following symbols may be useful: p_2, q_2

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Maths

Maxima and Minima: Problems 2ii

Maxima and Minima: Problems 2ii



A curve has equation $y = 3x^3 - 7x + \frac{2}{x}$

Part A Verify stationary point

Verify the curve has a stationary point when x = 1.

More practice questions?

Part B Nature of stationary point

Determine the nature of this stationary point.

Neither/inconclusive

Maximum

Minimum

Part C Tangent to curve

The tangent to the curve at this stationary point meets the y-axis at the point Q. Find the y-coordinate of Q.

Used with permission from UCLES, A Level, June 2014, Paper 4721, Question 8.



<u>Home</u> Maths Calculus Differentiation Minimising the area

Minimising the area



A rectangular cuboid has a base with sides of length a and b and a height c. Its volume V and height c are fixed. By following the steps below find expressions in terms of V and c for the values of a and b which will minimise the surface area a of the cuboid, find an expression for this minimum surface area and check that this is indeed a minimum.

Part A Volume V and surface area A

Write down the equation for the volume V of the rectangular cuboid in terms of a,b and a	Write	down	the e	guation	for the	volume	V	of the	rectangular	cuboid	in	terms	of	a.	b ar	nd	c
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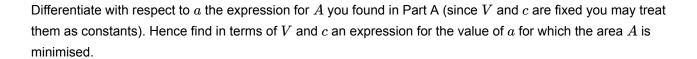
The following symbols may be useful: V, a, b, c

Write down the equation for the area A of the rectangular cuboid in terms of a, b and c.

The following symbols may be useful: A , $\,$ a , $\,$ b , $\,$ c

From your equation for V deduce an expression for b in terms of V, a and c. Hence, by substitution, obtain an equation for A in terms of V, a and c.

The following symbols may be useful: A, $\,$ V, $\,$ a, $\,$ c



The following symbols may be useful: V , $\ \ c$

Find, in terms of V and c, the expression for b corresponding to this value of a.

The following symbols may be useful: V, $\ c$

Part C The minimum area

Find an expression for the minimum area in terms of V and c.

The following symbols may be useful: V, $\ c$

Part D Check that the area is a minimum

Find, at the value of a deduced in Part B, an expression in terms of V and c for the second derivative of A with respect to a; convince yourself that the value of the second derivative indicates that the value of A is a minimum at this point.

The following symbols may be useful: V, c

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Maths

Stationary Points 4ii

Stationary Points 4ii



Part A Find coordinates
Find the coordinates of the stationary point on the curve $y=x^4+32x$. Enter the x and y coordinates below.
Enter x coordinate:
The following symbols may be useful: x
Enter y coordinate:
The following symbols may be useful: y
Part B Maxima or Minima
Determine whether this stationary point is a maximum or a minimum.
Maximum
Minimum
Part C Range of x
For what range of values of x does x^4+32x increase as x increases? Give your answer in the form of an inequality.
The following symbols may be useful: <, <=, >, >=, x



Maths

Calculus

Differentiation

Differentiating Natural Logs

Differentiating Natural Logs

Part A Differentiate $u=\ln(2v+3)$

Find
$$rac{\mathrm{d} u}{\mathrm{d} v}$$
 if $u = \ln(2v+3)$.

The following symbols may be useful: ν

Part B Stationary point of $p=2\ln(2q)-3q$

Find the coordinates and nature of the stationary point of the function $p = 2 \ln(2q) - 3q$.

Find the q coordinate of the stationary point.

The following symbols may be useful: q

Find the p coordinate of the stationary point.

The following symbols may be useful: $\ensuremath{\mathbf{p}}$

Determine the nature of the stationary point.

Minimum

Maximum

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Maths

Stationary Points 1ii

Stationary Points 1ii



The curve $y = x^3 - kx^2 + x - 3$ has two stationary points.

Part A Differentiate

Find $\frac{\mathrm{d}y}{\mathrm{d}x}$.

The following symbols may be useful: $k\,\text{,}\ \ x$

Part B Find k

Given that there is a stationary point when x=1, find the value of k.

The following symbols may be useful: \boldsymbol{k}

Part C Differentiate twice

Find $\frac{\mathrm{d}^2 y}{\mathrm{d} x^2}$.

The following symbols may be useful: x

Hence determine whether the stationary point is a minimum or a maximum.

Maximum

Minimum

Used with permission from UCLES, A Level, June 2009, Paper 4721, Question 10.

Maths

Stationary Points 1i

Stationary Points 1i



Part A Find stationary points

Find the coordinates of the stationary points on the curve $y=2x^3-3x^2-12x-7$. Enter the x and	$id\ y$
coordinates of the stationary point with the largest x coordinate.	

Enter the x coordinate:

The following symbols may be useful: $\boldsymbol{\boldsymbol{x}}$

Enter the y coordinate:

The following symbols may be useful: y

Part B Nature of stationary points

Determine whether each stationary point is a minimum or maximum point. Identify the nature of the stationary point whose coordinates you have entered in Part A.

Maximum
Maximum

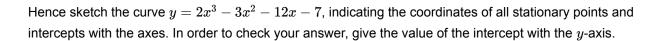
Minimum

Part C Expand and simplify

Expand and simplify $(x+1)^2(2x-7)$.

The following symbols may be useful: \boldsymbol{x}

Part D Sketch



The following symbols may be useful: \boldsymbol{y}

Used with permission from UCLES, A Level, Paper 4721 specimen, Question 8.



Home Maths Calculus Differentiation Differentiating Exponentials 3

Differentiating Exponentials 3

Part A Tangent to $y = e^{2x} - e^{-2x}$

Find the equation of the tangent to the curve $y = e^{2x} - e^{-2x}$ at the point $x = \frac{1}{2}$.

The following symbols may be useful: e, x, y

Part B Stationary point of $u=2\mathrm{e}^{3v}-3v$

Find the coordinates and nature of the stationary point of the function $u=2\mathrm{e}^{3v}-3v$.

Find the v coordinate of the stationary point.

The following symbols may be useful: $\boldsymbol{\nu}$

Find the u coordinate of the stationary point.

The following symbols may be useful: u

Determine the nature of the stationary point.

Minimum

Maximum

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