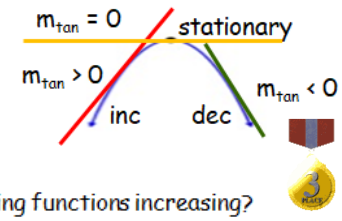
Outcome 1 – Increasing/decreasing functions



Bronze examples

Examples...

For what values of x is the function $y = x^2 + 10x - 7$ increasing?

$f'(x) = 2x + 10$

$2x + 10 > 0$

$2x > -10$

$x > -5$

A function is increasing if... $f'(x) > 0$

A function is decreasing if... $f'(x) < 0$

For what values of x is the function $y = \frac{1}{3}x^3 - 3x^2 - 16x$ decreasing?

1. Find the roots
2. Sketch the graph

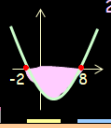
$f'(x) = x^2 - 6x - 16$

$x^2 - 6x - 16 < 0$

$x^2 - 6x - 16 = 0$

$(x - 8)(x + 2) = 0$

$x = 8, -2$



$-2 < x < 8$

Bronze questions

For what values of x are the following functions increasing?

1. $y = x^2 - 24x + 9$
2. $y = 5x^2 + 30x - 15$
3. $y = \frac{1}{3}x^3 - x^2 - 80x$

For what values of x are the following functions decreasing?

4. $y = x^2 + 18x - 7$
5. $y = 3x^2 + x + 40$
6. $y = x^3 - 9x^2$

Outcome 2 – Stationary functions

Silver examples

Examples...

For what value of x is the function $y = x^2 + 20x - 15$ stationary?

A function is stationary if... $f'(x) = 0$

$f'(x) = 2x + 20$

$2x + 20 = 0$

$2x = -20$

$x = -10$

For what values of x is the function $y = x^3 - 6x^2 - 36x$ stationary?

$f'(x) = 3x^2 - 12x - 36$

$x = 6$ and $x = -2$

$3x^2 - 12x - 36 = 0$

$3(x^2 - 4x - 12) = 0$

$3(x - 6)(x + 2) = 0$

Silver questions

For what value(s) of x are the following functions stationary?

1. $y = 4x^2 + 16x + 10$
2. $y = x^2 - 26x - 50$
3. $y = 2x^2 + 2x + 1$
4. $y = 2x^3 - 18x^2 - 96x - 23$
5. $y = x^3 - 3x^2 - 45x + 32$
6. $y = 12x^3 + 3x^2 - 6x + 11$

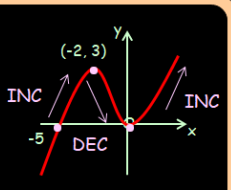
Outcome 3 – Sketching the graph of the derived function

Gold example

Examples...

The graph shows the sketch of the function y = f(x).

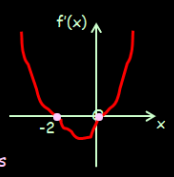
Sketch the graph of y = f'(x).



Sketch your axes...

@ SP's f'(x) = 0, so...

Put your SP's on the x-axis.



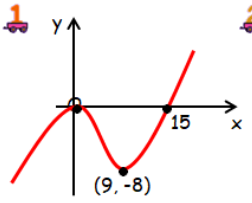
Increasing = above x-axis

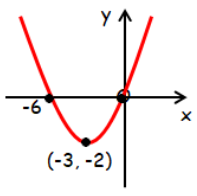
Decreasing = below x-axis

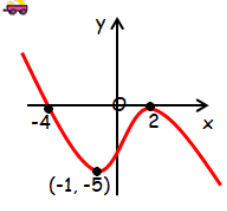
Note the cubic is now a quadratic!

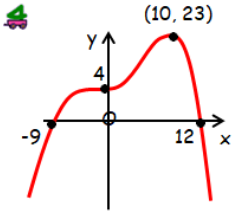
Gold questions

For each function, sketch the graph of y = f'(x)...

1. 

2. 

3. 

4. 

1. f(x) = quartic
   f'(x) = cubic
2. f(x) = cubic
   f'(x) = quadratic
3. f(x) = quadratic
   f'(x) = linear

Bronze Answers

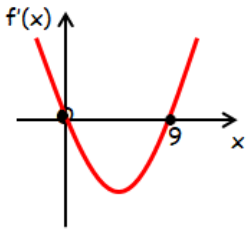
1. $x > 12$
2. $x > 3$
3. $x < -8, x > 10$
4. $x < -9$
5. $x < -1/6$
6. $0 < x < 6$

Silver Answers

1. $x = -2$
2. $x = 13$
3. $x = -\frac{1}{2}$
4. $x = -2, x = 8$
5. $x = -3, x = 5$
6. $x = 1/3, x = -1/2$

Gold Answers

1.



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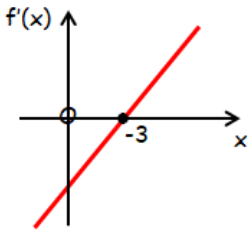

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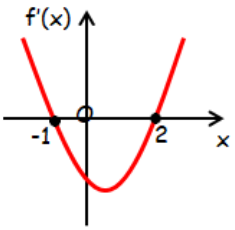

4.