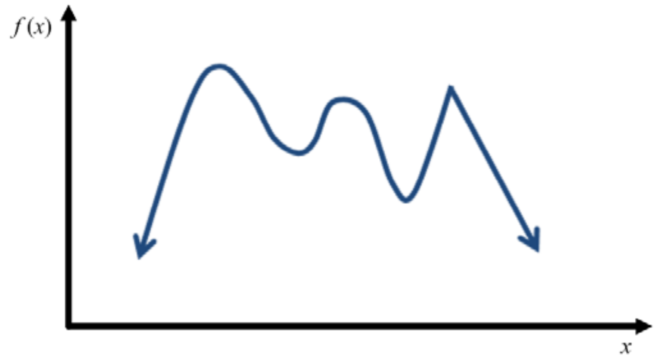
5.1 Extreme Values

NOTES

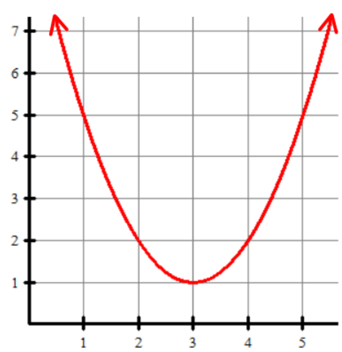
CALCULUS

Write your questions here!

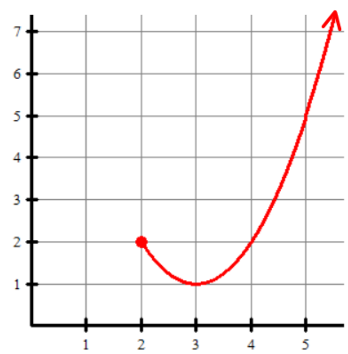
Extrema =



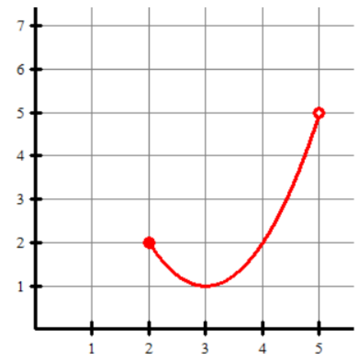
Critical Points =



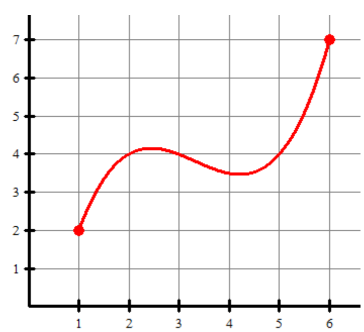
Domain: $(-\infty, \infty)$



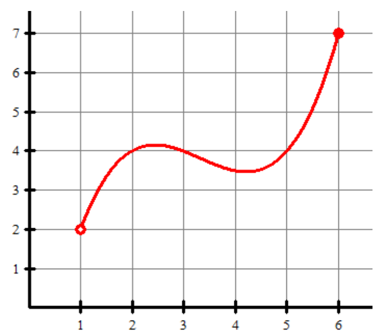
Domain: $[2, \infty)$



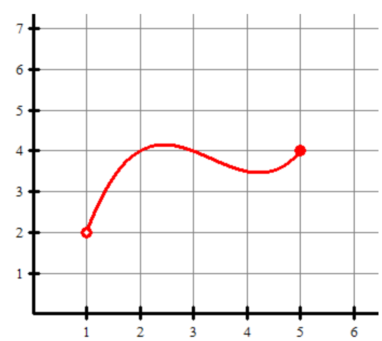
Domain: $[2, 5)$



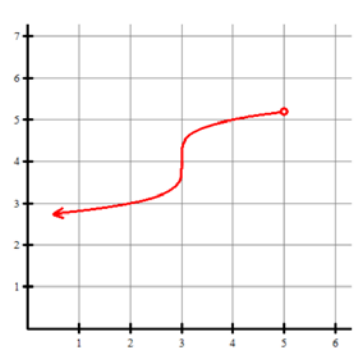
Domain: $[1, 6]$



Domain: $(1, 6]$

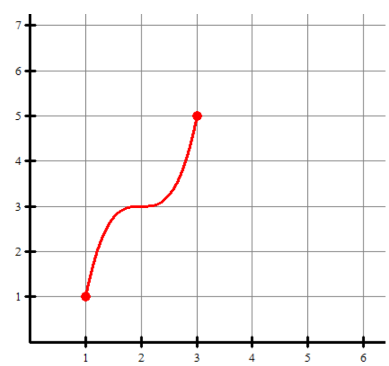


Domain: $(1, 5]$



Domain: $(-\infty, 6]$

Domain: $[1, 5)$



Domain: $[1, 3]$

Extreme Value Theorem

If *f* is continuous on a closed interval [*a*, *b*], then *f* has both a maximum and minimum value on the interval.

Find the critical points of the function.

$f(x) = \frac{1}{3}x^3 - 9x + 24$

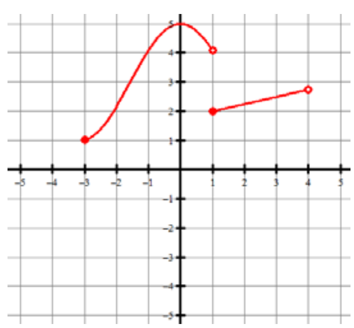
$g(x) = \frac{1}{\sqrt{4 - x^2}}$

Find the absolute maximum and minimum values of the function on the given interval.

$f(x) = x^3 - 3x^2 + 1, \quad \left[-\frac{1}{2}, 4\right]$

$h(x) = 2x - 3x^{\frac{2}{3}}, \quad [-1, 3]$

Find the extreme values and where they occur.



SUMMARY:

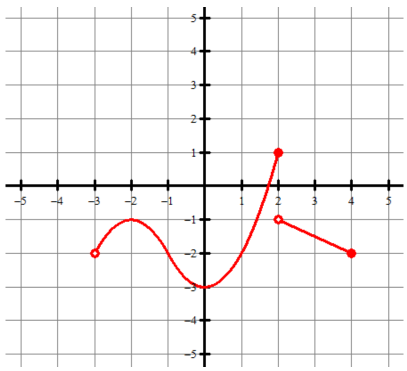
Now, summarize your notes here!

5.1 Extreme Values

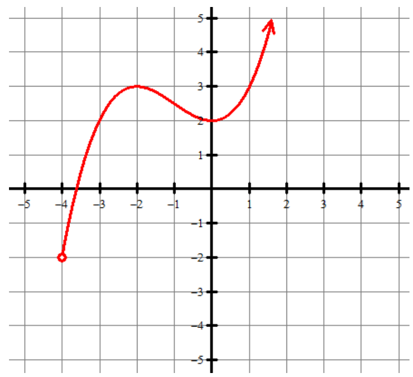
PRACTICE

Find the extreme values and where they occur.

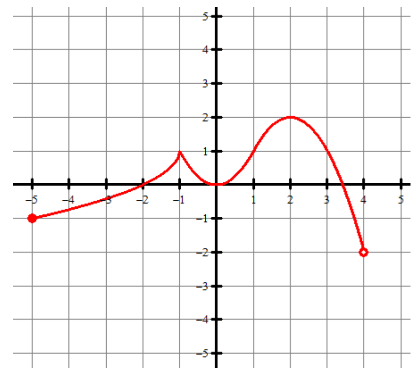
1.



2.

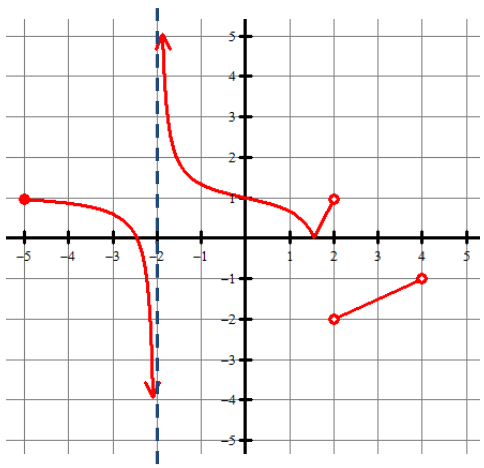


3.



Use the graph of $f(x)$ to answer the following.

4.



Domain:

$\lim_{x \to 2^+} f(x) =$

$\lim_{x \to -2} f(x) =$

$\lim_{x \to 0} f(x) =$

$f(3) =$

$f'(3) =$

Average rate of change over $[-5, -3]$

Absolute max:

Absolute min:

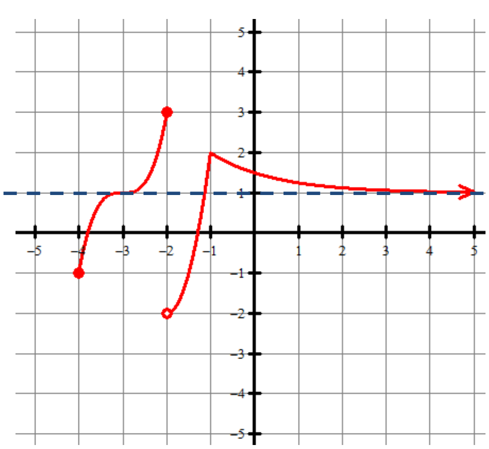
Local max:

Local min:

Interval(s) where $f(x)$ increasing

Interval(s) where $f(x)$ decreasing

5.



Domain:

$\lim_{x \to -2^+} f(x) =$

$\lim_{x \to -2} f(x) =$

$\lim_{x \to \infty} f(x) =$

$f(-3) =$

$f'(-1) =$

Average rate of change over $[-4, -2]$

Global max:

Global min:

Relative max:

Relative min:

Interval(s) where $f(x)$ increasing

Interval(s) where $f(x)$ decreasing

Find the critical points.

6. $f(x) = 4x^3 - 9x^2 - 12x + 3$

7. $g(t) = \frac{2}{t^2-4}$

8. $h(x) = \sqrt[3]{x-2}$

9. $f(x) = (\ln x)^2$

10. $h(x) = 2\sin\left(\frac{x}{2}\right)$

where $-2\pi \leq x \leq 2\pi$

11. $g(x) = e^x - x$

Find the absolute maximum and minimum values of the function on the given interval.

12. $f(x) = 1 + (x+1)^2, \quad [-2, 5]$

13. $f(x) = 2x^3 + 3x^2 + 4 \quad [-2, 1]$

14. $f(x) = x^3 - 12x, \quad [0, 3)$

15. $h(x) = 3x^{\frac{2}{3}} - 2x, \quad [-1, 1]$

Find the absolute maximum and minimum values of the function on the given interval.

16. $g(x) = x^2 + \frac{2}{x}, \quad \left(\frac{1}{2}, 2\right]$

17. $f(x) = \frac{x}{x^2+1}, \quad [-2, 2]$

18. $f(x) = \sin\left(x + \frac{\pi}{4}\right), \quad \left[0, \frac{7\pi}{4}\right]$

19. $g(x) = xe^{2x}, \quad [-1, 1]$

5.1 Extreme Values

TEST PREP

MULTIPLE CHOICE

1. If f is a continuous, decreasing function on $[0,10]$ with a critical point at $(4, 2)$, which of the following statements must be false?

   (A) $f(10)$ is an absolute minimum of f on $[0,10]$.

   (B) $f(4)$ is neither a relative maximum nor a relative minimum.

   (C) $f'(4)$ does not exist

   (D) $f'(4) = 0$

   (E) $f'(4) < 0$

Questions 2 and 3 refer to the graph shown on the right.

2. Which of the following statements is false?

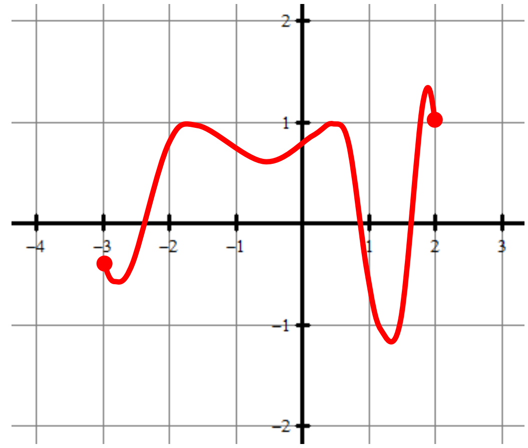
   (A) $F(-3) + F(2) > 0$

   (B) $F(-1) + F'(-1) > 0$

   (C) $F'(-1) \cdot F'(-2) < 0$

   (D) $F(1) \cdot F'(1) < 0$

   (E) $F(0) \cdot F'(0) > 0$



The graph of F

3. The function F has exactly this many critical numbers.

   (A) 4
   (B) 5
   (C) 6
   (D) 7
   (E) 8

4. Let $x(t) = t^{\frac{2}{3}}$ give the distance of a moving particle from its starting point as a function of time t. For what value of t is the instantaneous velocity of the particle equal to its average velocity over the interval [0,8] ?

   (A) $\frac{8}{27}$

   (B) $\frac{27}{64}$

   (C) $\frac{64}{27}$

   (D) $\frac{27}{8}$

   (E) $\frac{64}{9}$

5. What is the range of the function $f(x) = \frac{\ln x}{x}$ on the closed interval $[1, e^2]$?

   (A) $f(1) \leq f(x) \leq f(e)$

   (B) $f(1) \leq f(x) \leq f(e^2)$

   (C) $f(2) \leq f(x) \leq f(e)$

   (D) $f(e) \leq f(x) \leq f(e^2)$

   (E) None of these

 **You will need a graphing calculator for #6** 

6. Find the value of c that satisfies the Mean Value Theorem for $f(x) = x \sin x$ on [1,4].

   (A) 1.239
   (B) 1.290
   (C) 2.029
   (D) 2.463
   (E) 3.027