

Example 1: Finding Absolute Extrema on a Closed Interval

a. Find the absolute extrema of $f(x) = 3x^4 - 4x^3$ on the interval $[-1, 2]$.

Use your calculator to sketch the graph and verify.

b. Find the extrema of $f(x) = 2x - 3x^{2/3}$ on the interval $[-1, 3]$.

Use your calculator to sketch the graph and verify.

NOV 9 NOTES:

c. Find the extrema of $f(x) = 2 \sin x - \cos(2x)$ on the interval $[0, 2\pi]$.

Use your calculator to sketch the graph and verify.

$f'(x) = 2 \cos x + 2 \sin(2x)$

$0 = 2 \cos x + 2 \sin(2x)$

$0 = 2 \cos x + 4 \sin x \cos x$

$0 = 2 \cos x (1 + 2 \sin x)$

$2 \cos x = 0$

$\cos x = 0$

$x = \frac{\pi}{2}, \frac{3\pi}{2}$

$1 + 2 \sin x = 0$

$\sin x = -\frac{1}{2}$

$x = \frac{7\pi}{6}, \frac{11\pi}{6}$

max = 3
 $(\frac{\pi}{2}, 3)$

Min = $-\frac{3}{2}$

$(\frac{7\pi}{6}, -\frac{3}{2})$

$(\frac{11\pi}{6}, -\frac{3}{2})$

x	f(x)
0	-1 $0 - \cos 0$
2π	-1 $0 - \cos 4\pi$
$\frac{\pi}{2}$	3 $2 \sin \frac{\pi}{2} - \cos \frac{\pi}{2} = 2 - (-1)$
$\frac{3\pi}{2}$	-1 $2 \sin \frac{3\pi}{2} - \cos \frac{3\pi}{2} = -2 + (+1)$
$\frac{7\pi}{6}$	$-\frac{3}{2}$ $2 \sin \frac{7\pi}{6} - \cos \frac{7\pi}{6} = 2(-\frac{1}{2}) - (-\frac{1}{2}) = -1 - \frac{1}{2}$
$\frac{11\pi}{6}$	$-\frac{3}{2}$ $-1 - \cos \frac{11\pi}{6} = -1 - \cos \frac{2\pi}{3} = -1 - \frac{1}{2}$

Example 2: Finding the Minimum Slope

Find the smallest possible slope of the tangent line drawn to the curve $f(x) = 2x^3 - 3x^2 + 4x - 1$.
Verify your answer by graphing the function on your calculator.

$$\begin{array}{r|rrrr} 3 & 4 & -12 & 12 & 0 \\ & & 12 & 0 & 36 \\ \hline & 4 & 0 & 12 & 36 \end{array}$$

Example 3: Finding the Minimum/Maximum Velocity and Acceleration

A particle moves along a straight line with $s(t) = t^4 - 4t^3 + 6t^2 - 20$ for $0 \leq t \leq 3$ find

a.) the minimum and maximum velocity of the particle on the interval $0 \leq t \leq 3$.

$$v(t) = s'(t) = 4t^3 - 12t^2 + 12t$$

$$a(t) = v'(t) = 12t^2 - 24t + 12 = 0$$

$$12(t^2 - 2t + 1) = 0$$

$$(t-1)(t-1) = 0$$

$$t = 1$$

max vel = 36
min vel = 0

t	v(t)
0	0
1	4 - 12 + 12
3	36

b.) the minimum and maximum acceleration of the particle on the interval $0 \leq t \leq 3$.

$$a(t) = 12t^2 - 24t + 12$$

$$a'(t) = 24t - 24 = 0$$

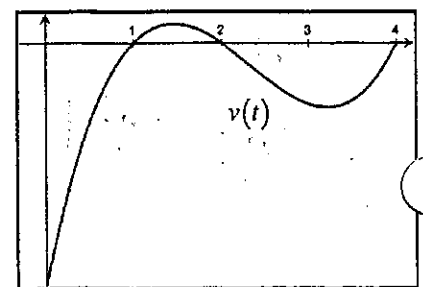
$$t = 1$$

max accel = 48
min accel = 0

t	a(t)
0	12
1	0
3	48

Example 4: Finding Extreme Position of a Moving Particle

A particle moves along the x-axis such that its position is $x(t) = 3t^4 - 28t^3 + 84t^2 - 96t + 1$ for $0 \leq t \leq 4$.
The graph of its velocity is below. Where is the particle when it reaches its rightmost position?



Homework Due Thursday

3.1 Hw Packet # 8, 10, 13, 16

Review Packet # 8(a)