```
> #This defines f at x as a function:
> f:=x->x^3/(x^2-4);
```

$$f := x \rightarrow \frac{x^3}{x^2 - 4} \tag{1}$$

```
> f(-x);
```

$$-\frac{x^3}{x^2 - 4} \tag{2}$$

```
#since f(-x) = -f(x), therefore function is odd.
> with(Student[Calculus1]);
```

[*AntiderivativePlot, AntiderivativeTutor, ApproximateInt, ApproximateIntTutor, ArcLength, ArcLengthTutor, Asymptotes, Clear, CriticalPoints, CurveAnalysisTutor, DerivativePlot, DerivativeTutor, DiffTutor, ExtremePoints, FunctionAverage, FunctionAverageTutor, FunctionChart, FunctionPlot, GetMessage, GetNumProblems, GetProblem, Hint, InflectionPoints, IntTutor, Integrand, InversePlot, InverseTutor, LimitTutor, MeanValueTheorem, MeanValueTheoremTutor, NewtonQuotient, NewtonsMethod, NewtonsMethodTutor, PointInterpolation, RiemannSum, RollesTheorem, Roots, Rule, Show, ShowIncomplete, ShowSteps, Summand, SurfaceOfRevolution, SurfaceOfRevolutionTutor, Tangent, TangentSecantTutor, TangentTutor, TaylorApproximation, TaylorApproximationTutor, Understand, Undo, VolumeOfRevolution, VolumeOfRevolutionTutor, WhatProblem*] **(3)**

```
> Asymptotes(f(x),x);
```

$$[y = x, x = -2, x = 2] \tag{4}$$

> #This tells you the absolute extremas

```
>  minimize (f(x));
```

$$-\infty \tag{5}$$

```
> maximize (f(x));
```

$$\infty \tag{6}$$

```
#This solves for the value of x when f(x) = 0 (aka x-intercepts)
> solve (f(x),{x});
```

$$\{x = 0\}, \{x = 0\}, \{x = 0\} \tag{7}$$

```
> This gives the first derivative of the function f(x) -> f'(x)
> f1:=x->diff(f(x),x);
```

$$f1 := x \rightarrow \frac{d}{dx} f(x) \tag{8}$$

```
> simplify (f1(x));
```

$$\frac{x^2 (x^2 - 12)}{(x^2 - 4)^2} \tag{9}$$

```
> #This solves for x when f'(x) = 0, i.e., either a local maxima
  or minima
> solve (f1(x),{x});
```

$$\{x = 0\}, \{x = 0\}, \{x = 2\sqrt{3}\}, \{x = -2\sqrt{3}\} \tag{10}$$

```
> subs (x=0,f(x));
```

$$0 \tag{11}$$

```
> subs (x=-2*sqrt(3),f(x));
```

$$-3\sqrt{3} \tag{12}$$

```
> subs (x=2*sqrt(3),f(x));
```

$$3\sqrt{3} \tag{13}$$

```
> #This gives the second derviate f''(x)
> f2:=x->diff(f1(x),x);
```

$$f2 := x \to \frac{d}{dx} f1(x) \tag{14}$$

```
> simplify(f2(x));
```

$$\frac{8x(x^2+12)}{(x^2-4)^3} \tag{15}$$

> # when f''(x)< 0, it means it's a local max, f''(x) > 0, it's a local min, f''(x)=0, it's an inflection point.

```
> subs (x=0,f2(x));
```

$$0 \tag{16}$$

```
> subs (x=-2*sqrt(3),f2(x));
```

$$-\frac{3}{4}\sqrt{3} \tag{17}$$

```
> subs (x=2*sqrt(3),f2(x));
```

$$\frac{3}{4}\sqrt{3} \tag{18}$$

```
> #This gives the inflection points (where concavity changes) -
  you dont have to worry about it for now.
> solve (f2(x),{x});
```

$$\{x=0\}, \{x=2\,\mathrm{I}\sqrt{3}\}, \{x=-2\,\mathrm{I}\sqrt{3}\} \tag{19}$$

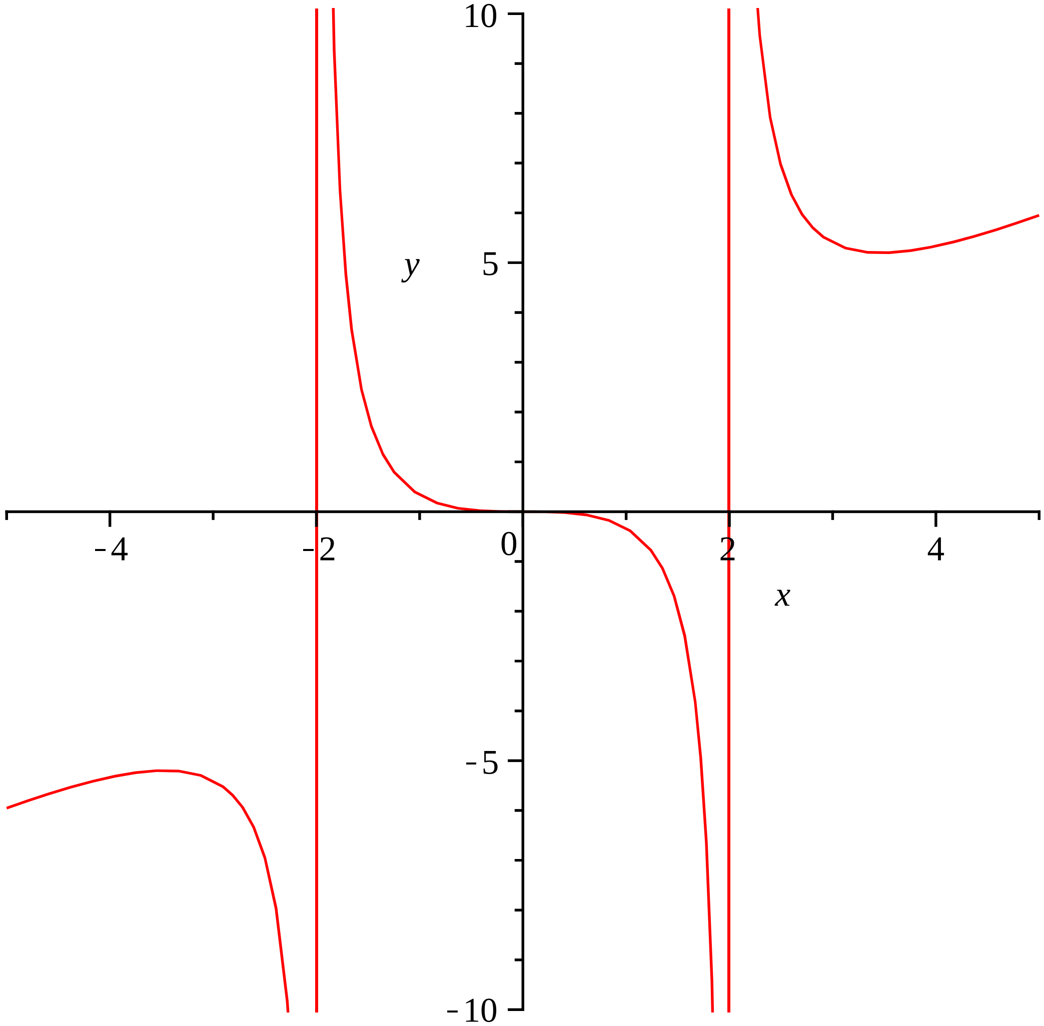
```
> #This will evaluate the limit at + infinitive
> limit (f(x), x=infinity);
```

$$\infty \tag{20}$$

```
> #This will evaluate the limit at - infinitive
> limit (f(x), x=-infinity);
```

$$-\infty \tag{21}$$

```
> #This will plot a graph for this function from x= -5 to 5:
> plot (f(x),x=-5..5, y= -10..10);
```



10
5
y
-5
-10
-4
-2
0
2
4
x