Instructor:

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## Limit of a function

```
limit(x^2 + 1, x = 2)
```

$$5 \quad \textbf{(1)}$$

```
f := x -> x^3 + 3
```

$$f := x \mapsto x^3 + 3 \quad \textbf{(2)}$$

```
limit(f(x), x = 1)
```

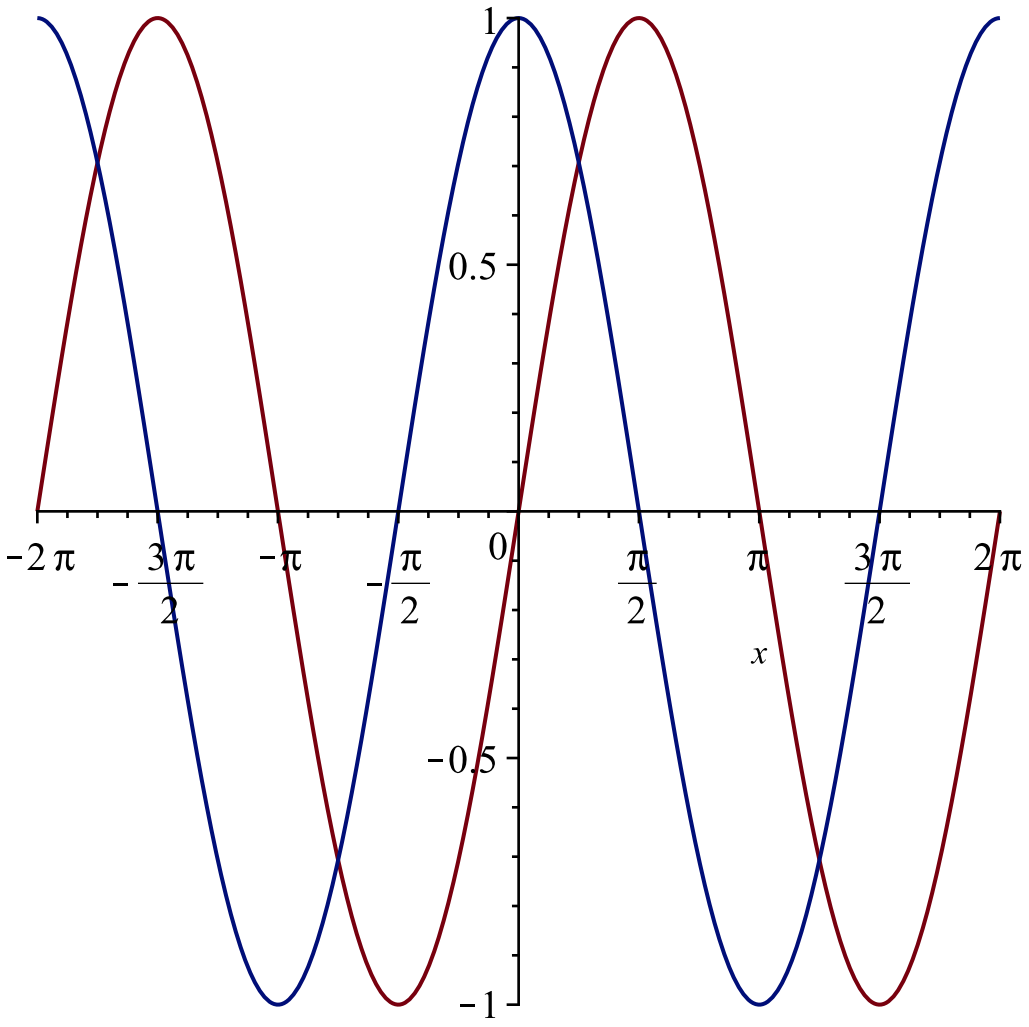
$$4 \quad \textbf{(3)}$$

```
limit(f(x), x = 1)
```

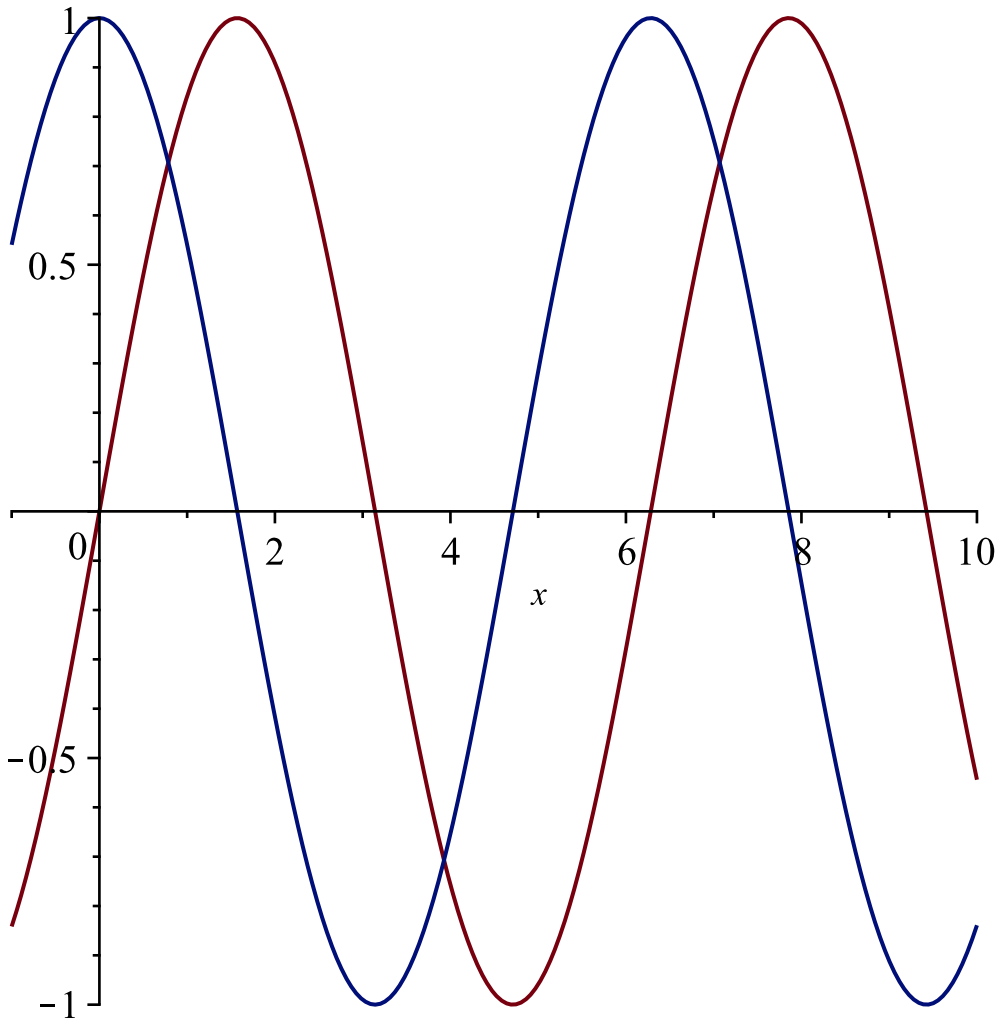
$$4 \quad \textbf{(4)}$$

## Plotting multiple function in single graph

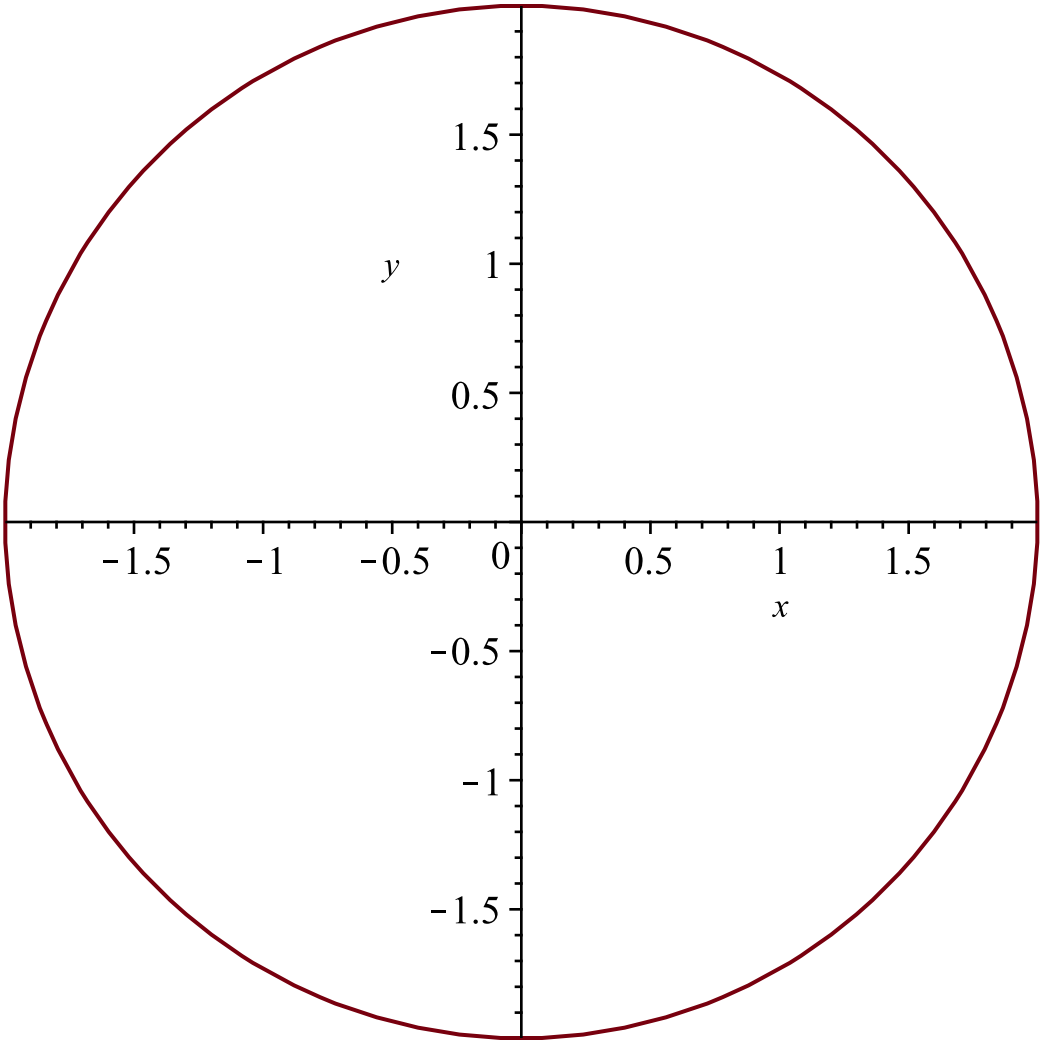
```
a := sin(x) :
b := cos(x) :

plot([a, b])
```




*plot*( [*a*, *b*], *x* = -1 ..10 )

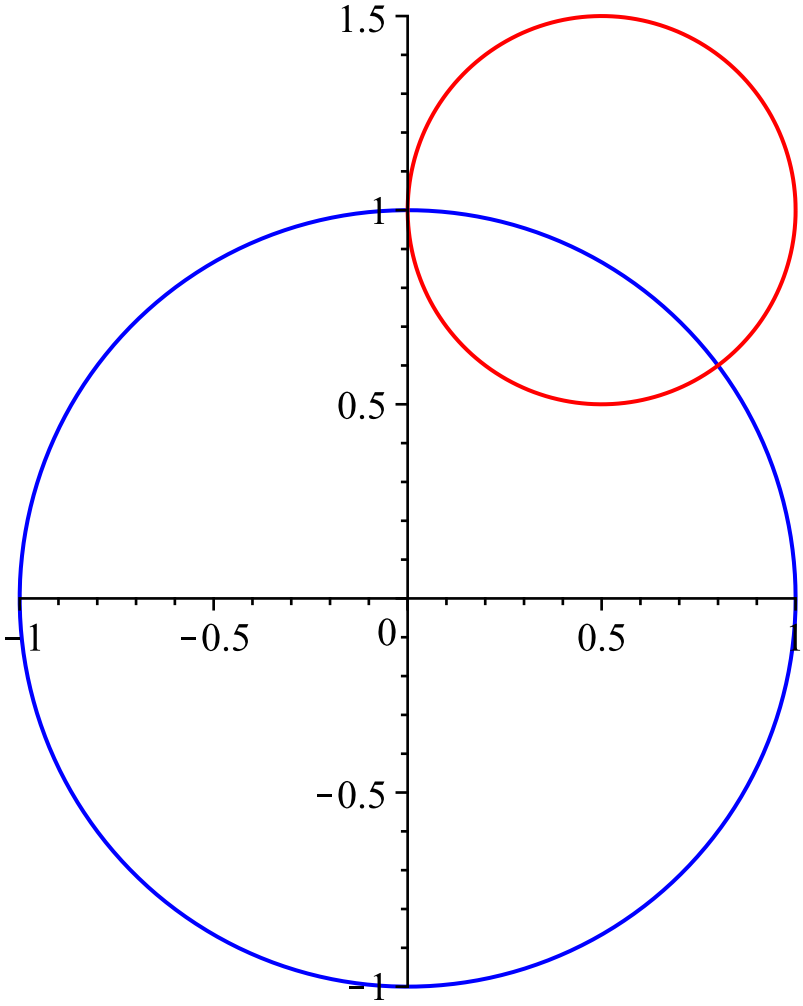



$with(plots):$
$implicitplot(x^2 + y^2 = 4, x = -2..2, y = -2..2)$

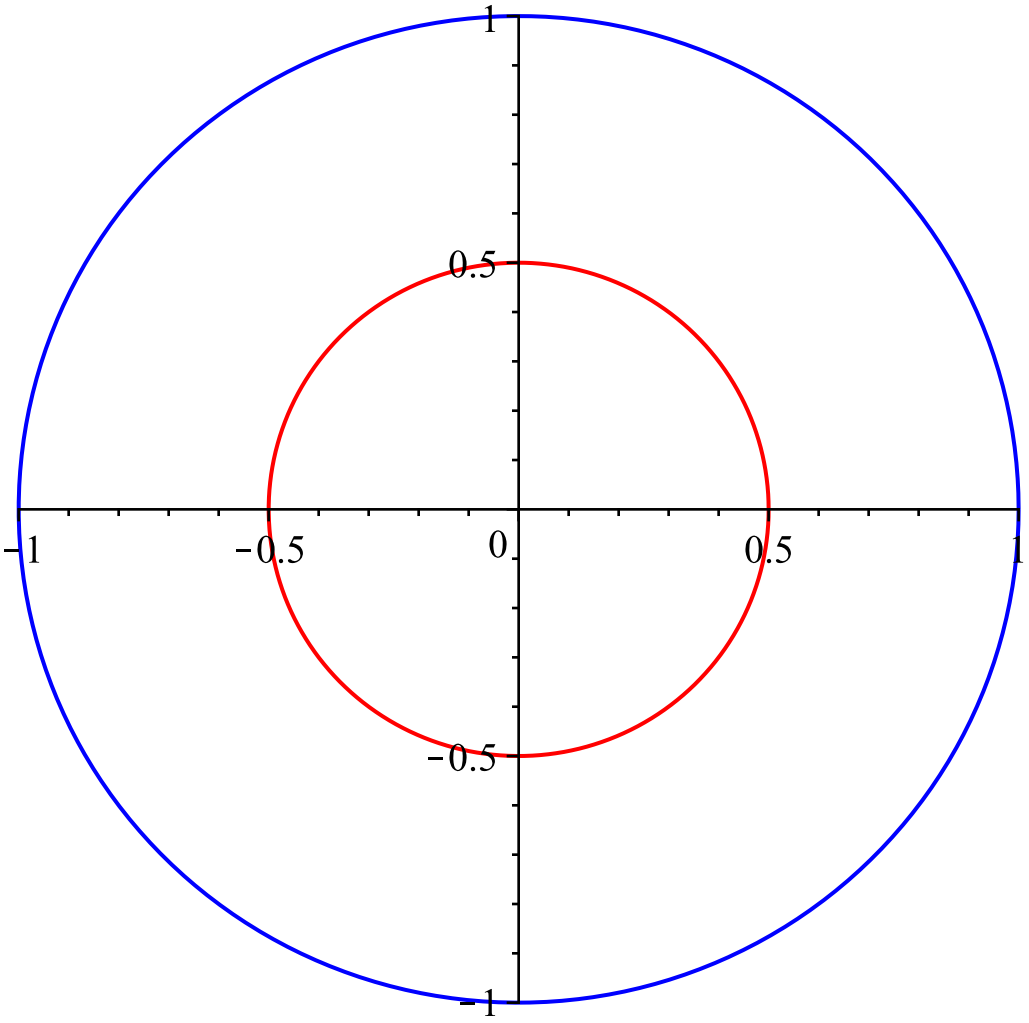



## Two circles

```
with(plottools):
c1 := circle([0, 0], 1, color = blue):
c2 := circle([1/2, 1], 1/2, color = red):
display(c1, c2)
```




```
with(plottools) :
c1 := circle([0, 0], 1, color = blue) :
c2 := circle([0, 0], 1/2, color = red) :
display(c1, c2)
```




## Test Continuity of a function

$iscont(\tan(x), x = 0..1)$

*true* **(5)**

$iscont(\tan(x), x = 0..1, 'open')$ Checking in Open interval

*true* **(6)**

$iscont(piecewise(x < 3, x + 8, x \geq 3, x^2 + 2), x = -\infty..\infty)$

*true* **(7)**

$$iscont\left(\frac{(x^2 - 4)}{x - 2}, x = 0..2\right)$$

*true* **(8)**

$$iscont\left(\frac{(x - 4)}{x - 2}, x = 0..2, 'closed'\right)$$ Checking on closed interval

*false* **(9)**

## Taylor and Maclaurin Series expansion

$$e^x \xrightarrow{\text{series in x}} 1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + O(x^5)$$

$series(\exp(x), x=0, 5)$

$$1 + x + \frac{1}{2} x^2 + \frac{1}{6} x^3 + \frac{1}{24} x^4 + O(x^5) \quad \textbf{(10)}$$

$e^x \xrightarrow{\text{series in x}} 1 + x + \frac{1}{2} x^2 + \frac{1}{6} x^3 + \frac{1}{24} x^4$

$taylor(e^x, x=1, 5)$

$$e + e\,(x-1) + \frac{1}{2} e\,(x-1)^2 + \frac{1}{6} e\,(x-1)^3 + \frac{1}{24} e\,(x-1)^4 + O((x-1)^5) \quad \textbf{(11)}$$

$taylor(\tan(x), x=\pi)$

$$(x-\pi) + \frac{1}{3} (x-\pi)^3 + \frac{2}{15} (x-\pi)^5 + O((x-\pi)^7) \quad \textbf{(12)}$$

For Maclurin Series use about x=0

$taylor(e^x, x=0, 5)$

$$1 + x + \frac{1}{2} x^2 + \frac{1}{6} x^3 + \frac{1}{24} x^4 + O(x^5) \quad \textbf{(13)}$$

Remove order term

$convert(series(\exp(x), x=0, 5), 'polynom')$

$$1 + x + \frac{1}{2} x^2 + \frac{1}{6} x^3 + \frac{1}{24} x^4 \quad \textbf{(14)}$$

$convert(taylor(\exp(x), x=0, 5), 'polynom')$

$$1 + x + \frac{1}{2} x^2 + \frac{1}{6} x^3 + \frac{1}{24} x^4 \quad \textbf{(15)}$$