wave group2

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1 To see what is the effect of adding up from 1 to 10 waves. This proccess shouls form a wave group

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we will use the following equation

$$y = A\cos(kx - \omega t)$$

However, we can study this equation at only a specific instance of time, say $t = 0$, and $A = 1$ thus

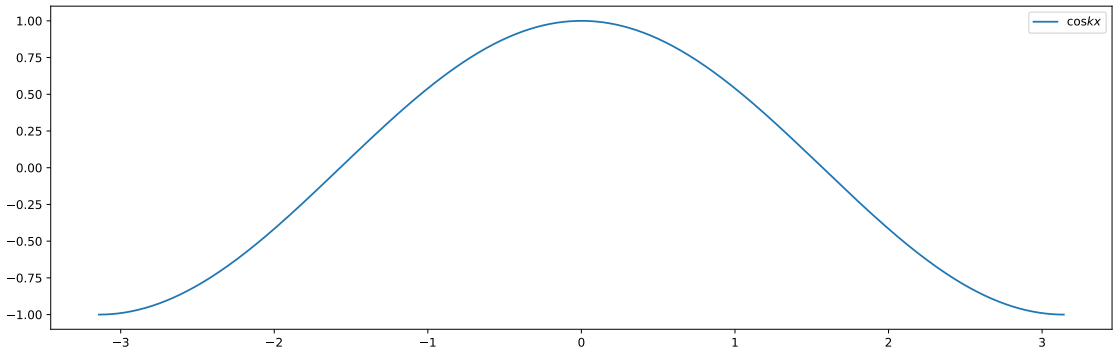
$$y = \cos kx$$

[1]:
```
# Import the needed libraries
import numpy as np
import matplotlib.pyplot as plt

# Setting the figure properties
from IPython.display import set_matplotlib_formats
set_matplotlib_formats('png', 'pdf')
plt.rc('figure', figsize=(16, 5))
```

1.1 Drawing One and Two Waves

[2]:
```
# max value of x-axis
limit = 1*np.pi
# number of waves to be added up
waves = 1

# x-axis values
x = np.arange(-limit, limit, 0.001)

#  function to calculate `y` value of added waves at given `x`
def wave2(x):
    result = 0
    for i in range(1, waves+1):
        result += np.cos(i * x)
        plt.plot
    return result
```

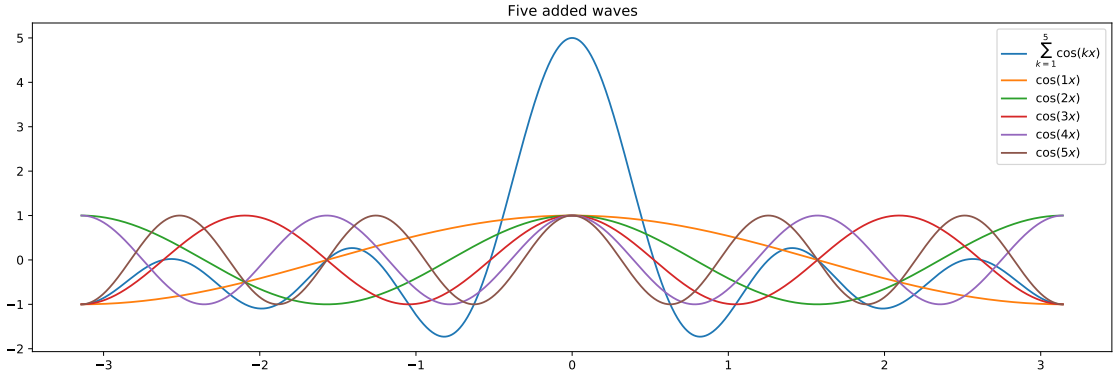
```
# normal cos() function, accept wavenuber value `k`
def wave(k, x):
    return np.cos(k*x)

# plotting
plt.plot(x, wave2(x), label='$\cos{kx}$')
for i in range(1, waves+1):
    # plt.plot(x, wave(i, x))
    pass


plt.legend()
plt.show()
```



1.2 Drawing Five Waves

along with thier original waves

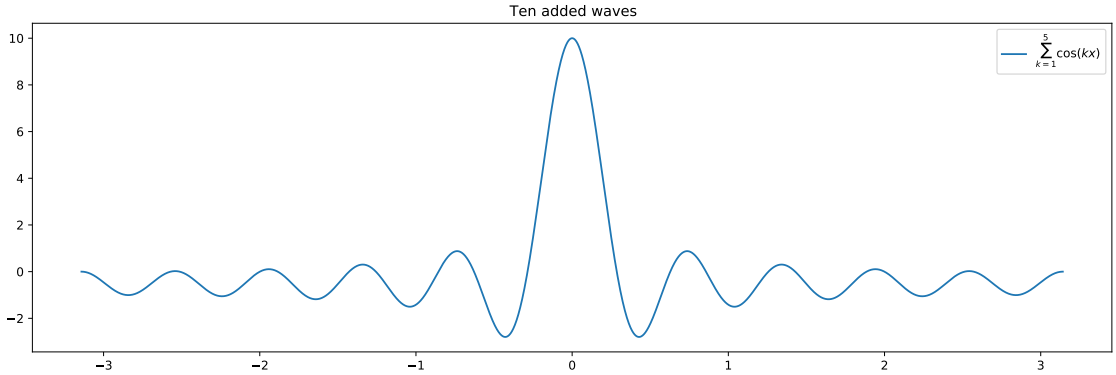
[3]:
```
# number of waves to be added up
waves = 5

# plotting
plt.plot(x, wave2(x), label='$\sum_{k=1}^{5}\cos{(kx)}$')
for i in range(1, waves+1):
    plt.plot(x, wave(i, x), label='$\cos{('+ f'{i}'+'x)}$')

plt.title('Five added waves')
plt.legend()
plt.show()
```



1.3 Drawing Ten Added Waves

we notice that the result wave becomes more and more loaclized

[4]:
```
# number of waves to be added up
waves = 10

# plotting
plt.plot(x, wave2(x), label='$\sum_{k=1}^{5}\cos{(kx)}$')

plt.title('Ten added waves')
plt.legend()
plt.show()
```



1.4 Drawing 50 Added Waves

[5]:
```
# number of waves to be added up
waves = 50

# plotting
```

```
plt.plot(x, wave2(x), label='$\sum_{k=1}^{5}\cos{(kx)}$')

plt.title('50 added waves')
plt.legend()
plt.show()
```