Homework 1
Jonathan Pilling

Problem 1

?? $= 0.2$
(a) $Pr(Y = 1) = 0.05 + 0.2 + 0.2 = 0.45$
(b) $Pr(X = 3) = 0.2 + 0.25 = 0.45$
(c) $Pr(X = 1 \cap Y = 2) = 0.15$
(d) $Pr(X = 1 \cup Y = 2) = 0.2 + 0.15 + 0.15 + 0.25 = 0.75$

Problem 2
For this problem we need to compute expectation of random variable B and H.

$E[B] = 1/4 * (1 + 3 + 5 + 6) = 15/4$
Expectation for this one is easy, multiply probability by random variables

$E[H] = \int_{-1}^{5} 1/6xdx = 1/12x^2\big|_{-1}^{5} = 2$
For getting expectation from pdf we do Integral

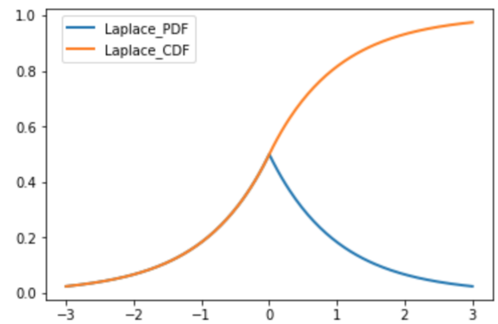
Adding these two expectations together, we get our distance we expect the man to jog each morning.
$E[B] + E[H] = 15/4 + 2 = 23/4$ miles

Problem 3

In [28]:
```
import matplotlib as mpl
import matplotlib.pyplot as plt

from scipy.stats import laplace
import numpy as np
import math

mu = 0
variance = 1
sigma = math.sqrt(variance)
x = np.linspace(-3, 3, 201)
plt.plot(x, laplace.pdf((x-mu)/sigma),linewidth=2.0, label='Laplace_PDF')
plt.plot(x, laplace.cdf((x-mu)/sigma),linewidth=2.0, label='Laplace_CDF')
plt.legend(bbox_to_anchor=(.35,1))
plt.savefig('Gaussian.pdf', bbox_inches='tight')
```



Problem 4

$P(M|D) = P(D|M) * P(M)$ Where $P(D|M)$ is likelihood of model M
$P(D|M) = \prod_{x \epsilon \Omega} (1/2\pi exp^{-1/2(x-M)^2})$

Taking log likelihood of this function gives
$\sum_{x \epsilon \Omega} (-1/2(x-M)^2) + |D| ln(1/\sqrt{2\pi})$

We can ignore the 2nd term because it doesn't contain M
Maximum likelihood model = mean of data set
$P(D|M) = 9/5$

$P(M) = E[M] = -1 * 0.2 + 2 * 0.5 + 4 * 0.3 = 2$

$P(M|D) = P(D|M) * P(M) = 9/5 * 2 = 18/5$