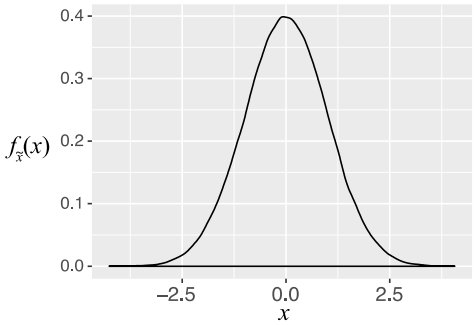
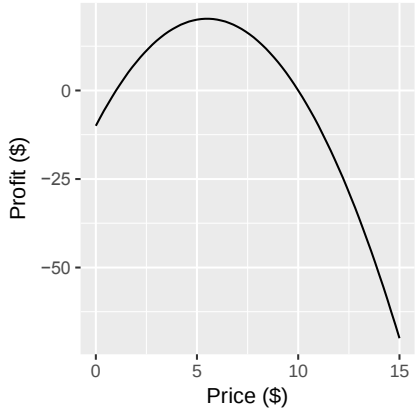
EMSE 6035 - Marketing of Technology
Concept Self-Assessment

1. A random variable, $\tilde{x}$, has the probability density function (PDF), $f_{\tilde{x}}(x)$, shown below.
   - What is the approximate probability that $\tilde{x} = 0$?
   - At $x = 0$, the PDF is at approximately 0.4, so there is approximately a 40% probability that $\tilde{x} = 0$.
   - What is the approximate probability that $\tilde{x} < 0$?
   - The distribution is symmetric around $\tilde{x} = 0$, so the probability that $\tilde{x} < 0$ is approximately 0.5, or a 50% probability.



2. The chart below shows a profit function, $\pi = f(p)$, where p is price.
   - At approximately what price is profit maximized?
   - The peak of the curve is at approximately $5.50.
   - What is the value of $\frac{df}{dp}(p)$ at that price?
   - Since the function is at its maximum value when the price is $5.50, the slope at that point should be 0. Therefore, the first derivative of $f(p)$, $\frac{df}{dp}(p)$, at the maximizing value of p is 0.
   - Is $\frac{d^2f}{dp^2}(p)$ positive or negative at that price?
   - Since the curve is concave, the second derivative of $f(p)$, $\frac{d^2f}{dp^2}(p)$, at the maximizing value of p is *negative*.



3. A student estimates the following linear regression using the *mtcars* dataset in *R*:

$$f = \beta_0 + \beta_1 w$$

where *f* is the vehicle fuel economy (in miles per gallon), and *w* is the vehicle weight (in 1,000 lbs). The regression produces the following results:

	Estimate	Standard Error	t value	Pr(>|t|)
β_0	37.285	1.8776	19.858	8.24E-19
β_1	-5.344	0.5591	-9.559	1.29E-10

- How would you interpret the meaning of the coefficients β_0 and β_1?
- The meaning of β_0 is the fuel economy (in mpg) of a hypothetical vehicle with zero weight. The meaning of β_1 is the decrease in fuel economy (in mpg) for every increase in 1,000 lbs of a vehicle's weight.
- Use the results of this regression to predict the fuel economy of a car that weighs 4500 pounds.
- To compute the expected fuel economy of a car weighing 4500 lbs, we simply evaluate f using the estimated coefficient values (note that the weight is input at 4.5 since *w* is in 1000 lbs): $f = 37.285 - 5.344(4.5) = 13.237$ mpg