NOTES

# 5.3 Application and Extension

**Use a graphing calculator!**

1. From 1994 to 2003, the average salary $S$ of hotdog vendors in New York can be modeled by
$$S(t) = -5.2t^3 + 80.4t^2 - 120.2t + 100$$
where $t$ is the number of years since 1994. Find a good viewing window for the graph of $S$.

Xmin: 0
Xmax: 10
Xscl: 1
Ymin: 0
Ymax: 2500
Yscl: 500

2. The data in the table gives the annual consumption of hydroelectric power (in quadrillion BTU) in the United States for selected years since 1983.

U.S. Consumption of Hydroelectric Power

| Year | Quadrillion BTU | |
|---|---|---|
| 1983 | 4.8 | |
| 1985 | 4.9 | |
| 1987 | 5.2 | |
| 1989 | 5.4 | ← MAX |
| 1991 | 5.3 | |
| 1993 | 5.0 | |
| 1995 | 4.7 | |
| 1997 | 4.71 | |
| 1999 | 4.5 | |
| 2001 | 4.3 | ← MIN |
| 2003 | 4.5 | |
| 2005 | 4.8 | |

Source: U.S. Department of Energy

   a. From the table, identify any years in which a polynomial model would have an obvious turning point. (A 0.01 change is not an obvious turning point!)

1989 & 2001

   b. Based on the number of turning points you identified in part a, what is the smallest degree possible for this model? 3

   c. Using your calculator, find a regression model.

$y = 9.050x^3 - 0.031x^2 + .258x + 4.684$

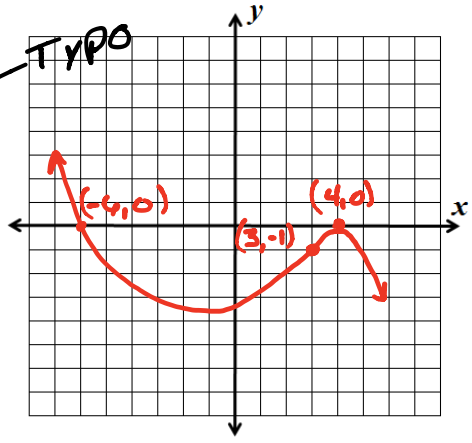
   d. Use the model to predict the consumption of hydroelectric power in 2018. 13.977 Quadrillion BTU

   e. Compare the consumption of hydroelectric power in 2003 (from the table) to the consumption given by the model.

Table 4.5 vs model 4.4975

3. $P(x)$ is cubic. $P(4) = 0, P(3) = -1$, and $P(x) > 0$ only when $x > 6$. Sketch a possible graph, then find the equation of $P(x)$. (Your equation may be left in factored form, but don't forget to find the leading coefficient.)

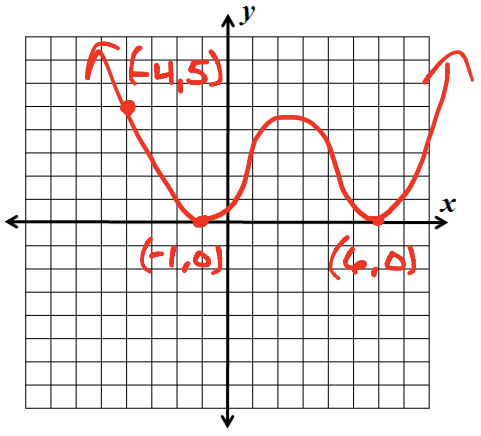
TYPO




$P(x) = a(x-4)^2(x+6)$
$-1 = a(3-4)^2(3+6)$
$-1 = a(-1)^2(9)$
$-1 = a(1)(9)$
$-\frac{1}{9} = a$

$P(x) = -\frac{1}{9}(x-4)^2(x+6)$

4. Write and graph the equation for a quartic function passing through the point $(-4, 5)$ and tangent to the $x$-axis at $x = -1$ and $x = 6$. Don't forget to find the leading coefficient.




$f(x) = a(x+1)^2(x-6)^2$
$5 = a((-4)+1)^2((-4)-6)^2$
$5 = a(-3)^2(-10)^2$
$5 = a(9)(10)$
$\frac{5}{9(10)} = a$
$\frac{1}{9(2)} = 9$
$\frac{1}{18} = 9$

$f(x) = \frac{1}{18}(x+1)^2(x-6)^2$