WARM UP EXERCISE
The total sales of a company (in millions of dollars) $t$ months from now are given by

$$S(t) = 0.015t^4 + 0.4t^3 + 3.4t^2 + 10t - 3$$

Find $S'(t)$. Find $S(4)$ and $S'(4)$. Write a brief verbal interpretation of these results.

§11.3 Derivatives of Products and Quotients
The student will learn about:

- the derivative of a product of two functions
- the derivative of a quotient of two functions.
## Derivates of Products

### Theorem 1 - Product Rule

If \( f(x) = F(x) \cdot S(x) \),

Then \( f'(x) = F(x) \cdot S'(x) + S(x) \cdot F'(x) \),

\[
f'(x) = F \frac{dS}{dx} + S \frac{dF}{dx}
\]

Find the derivative of \( y = 5x^2(x^3 + 2) \).

### Example

Find the derivative of \( y = 5x^{1/2}(3x^2 - 5x) \).
Derivatives of Quotients

Theorem 2. Quotient Rule:

If \( f(x) = \frac{T(x)}{B(x)} \), then

\[
f'(x) = \frac{B(x) \cdot T'(x) - T(x) \cdot B'(x)}{[B(x)]^2}
\]

Find the derivative of \( f(x) = \frac{3x}{2x + 5} \).

Example

Find the derivative of \( S(t) = \frac{90t^2}{t^2 + 50} \).
Application

Total sales $S$ in thousands of CD’s for a CD company are given by

$$S(t) = \frac{90t^2}{(t^2+50)}$$

where $t$ is the number of months since the release of the CD.

We saw that $S'(t)=(9000t)/(t^2+50)^2$.

1. Find $S(10)$ and $S'(10)$.
2. Estimate total sales after 11 months.

More Examples

$$f(x) = \frac{2x - 4}{5x + 3}$$

$$g(x) = \frac{6\sqrt{x}}{x^2 - 3}$$

$$h(x) = \frac{5x^3 - 2x}{(x^2 - 3)^{3/2}}$$