

## PDF 5.050 Optimization Involving Exponential Functions

### Example 1

The effectiveness of studying for an exam depends on how many hours a student studies. Some experiments show that if the effectiveness,  $E$  is put on a scale from 0 to 10, then

$$E(t) = 0.5 \left[ 10 + te^{\frac{-t}{20}} \right]$$

where  $t$  is the number of hours spent studying for an examination. If a student has up to 30 hours for studying, how many hours are needed for maximum effectiveness?

### Example 2

A consultant determines that the proportion of people who have responded to the advertisement of a new product after it has been marketed for  $t$  days is given by  $f(t) = 0.7(1 - e^{-0.2t})$ . The area covered by that advertisement contains 10 million potential customers and each response to the ad yields revenue of \$0.70 on average (excluding the cost of advertising). The ad costs \$30000 to produce and a further \$5000 per day to run.

- a) Determine  $\lim_{t \rightarrow \infty} f(t)$  and interpret the result.
- b) What percent of potential customers have responded after 7 days of advertising?
- c) c) Write the function  $P(t)$  that represents the average profit after  $t$  days of advertising. What is the average profit after 7 days?
- d) d) For how many full days should the ad campaign be run in order to maximize the average profit? Assume an advertising budget of \$200000.