**Derivatives of Exponential Functions**

Find the derivative of each of the following functions.

1.  2.  3. 

4.  5.  6. 

7.  8.  where A and c are constants.

9.  10.  11. 

12. The voltage drop across a component of an electric circuit is given by the function

  where V(t) is measured in volts and t is time in seconds.

 A) What is the voltage drop and how fast is it changing when t = 1 second?

 B) Graph V(t). What happens to the voltage drop in the long run?

13. In example 1 we derived a model for the population of FL as a function of time in years since 1990. The function was .

 A) What does this model predict for the population of FL in the year 2000 and its rate of change?

 B) What does P(11) – P(10) mean in context? How does it compare with the answer in part A.

 C) On the graph of P(t) show the values calculated in parts A and B.

14. The graph of  has a horizontal tangent line at what value of x? What is special about the graph at that point?

15. Suppose that a culture of bacteria grows in such a way that it starts with 100 bacteria doubles every three hours. Write a function that gives the number of bacteria as a function of time. What does the function predict will be the number of bacteria after 30 hours and at what rate will it be growing?

Answers:

1. $V^{'}\left(t\right)=-200e^{-2t}$
2. $f^{'}\left(t\right)=\frac{5e^{\sqrt{x}}}{\sqrt{x}}$
3. $f^{'}\left(t\right)=-2e^{-2x}\cos(\left(πx\right))-πe^{-2x}\sin(\left(πx\right))$
4. $Q^{'}\left(t\right)=\frac{xe^{x}-e^{x}}{x^{2}}$
5. $f^{'}\left(t\right)=\frac{3e^{3x}}{2\sqrt{e^{3x}+1}}$
6. $g^{'}\left(t\right)=x^{3}+3^{x}ln⁡(x)$
7. $p^{'}\left(t\right)=40\left(\frac{1}{2}\right)^{t}ln⁡(\frac{1}{2})$
8. $y^{'}=Ace^{cx}$
9. $y^{'}=2\cos(\left(2x\right))e^{\sin(\left(2x\right))}$
10. $y^{'}=Ae^{cx}+Axce^{cx}$
11. $y^{'}=140e^{2x}(e^{2x}+3)^{6}$
12. a) $V(1)= 8.65 and V'(1) =2.71$; b) approaches 10.
13. A) 18.8, 0.56; B) The average rate of change in the population between 2000 and 2001. It is approximately the same.
14. *x* = 1. It has a turning point there.
15. $A=P\left(t\right)=100(2)^{t/3}, P(30)= 102400, P'(30) = 23659.4$

More derivative practice:

Find the derivatives of the following functions.

|  |  |
| --- | --- |
| 1.  | 11.  |
| 2.  | 12.  |
| 3.  | 13.  |
| 4.  | 14.  |
| 5.  | 15.  |
| 6.  | 16.  |
| 7.  | 17.  |
| 8.  | 18.  |
| 9.  | 19.  |
| 10.  | 20.  |

Answers toMore derivative practice:

|  |  |
| --- | --- |
| 1.   | 11.   |
| 2.   | 12.   |
| 3.   | 13.   |
| 4.   | 14.   |
| 5.   | 15.   |
| 6.   | 16.   |
| 7.   | 17.   |
| 8.   | 18.   |
| 9.   | 19.   |
| 10.   | 20.   |