

AP Calculus  
Exponential Growth and Decay Problems

Name \_\_\_\_\_

Date \_\_\_\_\_

Solve.

1. Write an equation for the amount  $Q$  of a radioactive substance with a half-life of 30 days, if 10 grams are present when  $t = 0$ .

a)  $Q(t) = 10e^{-0.0231t}$       b)  $Q(t) = 10e^{15t}$   
c)  $Q(t) = 10e^{-5.4772t}$       d)  $Q(t) = 10e^{43.2901t}$   
e)  $Q(t) = 10e^{-0.1667t}$

2. A mold culture doubles its mass every three days. Find the growth model for a plate seeded with 1.2 grams of mold.

a)  $y = 1.2e^{0.10034t}$       b)  $y = 1.2e^{0.23105t}$   
c)  $y = 1.2e^{0.23856t}$       d)  $y = 1.2e^{0.38761t}$   
e)  $y = 1.2e^{0.54931t}$

3. In 1990 the population of a village was 21,000 and in 2000 it was 20,000. Assuming the population decreases continuously at a constant rate proportional to the existing population, estimate the population in the year 2020.

a) 17,619      b) 18,000      c) 19,048  
d) 18,141      e) 18,376

4. In 1995 the population of a town was 35,000 and in 2001 it was 30,000. Assuming the population decreases continuously at a constant rate proportional to the existing population, estimate the population in the year 2010.

a) 20,143      b) 22,982      c) 21,327  
d) 23,807      e) 51,439

5. The population  $P$  of a herd is given by  $P = 2000e^{kt}$ . Let  $t = 0$  correspond to the year 1998 and suppose the population in 1995 was 1700. Use this model to predict the population in 2005.

a) 2922    b) 2517    c) 1815    d) 3218    e) 2623

6. The population  $P$  of a suburb is given by  $P = 5000e^{kt}$ . Let  $t = 0$  correspond to the year 1996 and suppose the population in 1990 was 3600. Use this model to predict the population in 2010.

a) 10761      b) 10137      c) 11308  
d) 9518      e) 11904

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7. A population increases continuously at a rate proportional to the number present. If there are 750 present at a given time and 2,250 present 5 hours later, how many will there be 7 hours from the initial time given?
- a) 3,018      b) 2,871      c) 3,492  
d) 3,953      e) 4,308
8. A population increases continuously at a rate proportional to the number present. If there are 400 present at a given time and 2,000 present 3 hours later, how many hours (from the initial given time) will it take for the numbers to be 3,700? Round your answer to 2 decimal places.
- a) 3.29    b) 3.82    c) 4.15    d) 4.67    e) 5.23
9. A radioactive element has half-life of 50 days. What percentage of the original sample is left after 85 days?
- a) 24.06%      b) 25.00%      c) 28.22%  
d) 30.78%      e) 37.50%
10. What percentage of an original sample of a radioactive element is left after 48 days? The half-life of the radioactive element is 40 days.
- a) 25.00%      b) 37.50%      c) 40.03%  
d) 43.53%      e) 49.56%
11. The number  $N$  of bacteria in a culture is given by  $N = 350e^{kt}$ . If  $N = 450$  when  $t = 6$  hours, find  $k$  (to the nearest hundredth) and then determine approximately how long it will take for the number of bacteria to increase 5-fold in size.
- a) 38.4 hours    b) 30 hours      c) 46.3 hours  
d) 37.2 hours    e) 43.7 hours
12. A deposit of \$1,000 is made into a fund with an annual interest rate of 10 percent. Find the time (in years) necessary for the investment to double if the interest is compounded continuously. Round your answer to 2 decimal places.
- a) 6.17    b) 6.93    c) 7.23    d) 10      e) 20

1.  
Answer:      a  
CodePath:    EAS.APC.G.F.1
2.  
Answer:      b  
CodePath:    EAS.APC.G.F.3
3.  
Answer:      d  
CodePath:    EAS.APC.G.F.11
4.  
Answer:      d  
CodePath:    EAS.APC.G.F.12
5.  
Answer:      a  
CodePath:    EAS.APC.G.F.13
6.  
Answer:      a  
CodePath:    EAS.APC.G.F.14
7.  
Answer:      c  
CodePath:    EAS.APC.G.F.17
8.  
Answer:      c  
CodePath:    EAS.APC.G.F.18
9.  
Answer:      d  
CodePath:    EAS.APC.G.F.20
10.  
Answer:      d  
CodePath:    EAS.APC.G.F.21
11.  
Answer:      a  
CodePath:    EAS.APC.G.F.24
12.  
Answer:      b  
CodePath:    EAS.APC.G.F.5