1. A stone is thrown straight up from the top of a building with initial velocity 40 ft/sec and hits the ground 4 seconds later. The height of the building in feet is:

   a. 88 b. 96 c. 112 d. 128 e. 144

2. If a car accelerates from 0 to 60 mph in 10 seconds, what distance does it travel in those 10 seconds? (assume the acceleration is constant and note that 60 mph = 88 ft/sec)

   a. 40 ft b. 44 ft c. 88 ft d. 400 ft e. 440 ft

3. If the velocity of a car traveling in a straight line at time *t* is *v(t)*, then the difference in its odometer readings between times *t = a* and *t = b* is:

   a. $\int_a^b |v(t)|dt$ b. $\int_a^b v(t)dt$

   c. the net displacement of the car's position from *t=a* to *t=b*.

   d. the change in the car's position from *t=a* to *t=b*.

   e. none of these.

4. If an object is moving up and down along the y-axis with velocity $v(t)$ and $s'(t) = v(t)$, then it is false that $\int_a^b v(t)dt$ gives:

   a. *s(b) – s(a)*

   b. the net distance traveled by the object between *t=a* and *t=b*.

   c. the total change in *s(t)* between *t=a* and *t=b*.

   d. The shift in the object's position from *t=a* and *t=b*.

   e. The total distance covered by the object from *t=a* and *t=b*.

5. The function *f(x)* which satisfies the equations $f(x)f'(x) = x$ and $f(0) = 1$ is:

   a. $f(x) = \sqrt{x^2 + 1}$ b. $f(x) = \sqrt{1 - x^2}$ c. $f(x) = x$

   d. $f(x) = e^x$ e. None of these

6. The curve that passes through the point (1,1) and whose slope at any point (x,y) is equal to $\frac{3y}{x}$ has the equation:

   a. $3x - 2 = y$ b. $y^3 = x$ c. $y = |x^3|$ d. $3y^2 = x^2 + 2$ e. $3y^2 - 2x = 1$

7. If $\frac{dy}{dx} = \frac{y}{2\sqrt{x}}$ and y = 1, when x = 4, then:

   a. $y^2 = 4\sqrt{x} - 7$ b. $\ln y = 4\sqrt{x} - 8$ c. $\ln y = \sqrt{x - 2}$ d. $y = e^{\sqrt{x}}$ e. $y = e^{\sqrt{x} - 2}$

8. If $\frac{dy}{dx} = e^y$ and y = 0 when x = 1, then:

a. $y = \ln|x|$ b. $y = \ln|2-x|$ c. $e^{-y} = 2 - x$ d. $y = -\ln|x|$ e. $e^{-y} = x - 2$

9. If $\frac{dy}{dx} = \frac{x}{\sqrt{9+x^2}}$ and y = 5 when x = 4, then:

a. $y = \sqrt{9+x^2} - 5$ b. $y = \sqrt{9+x^2}$ c. $y = 2\sqrt{9+x^2} - 5$

d. $y = \frac{\sqrt{9+x^2} + 5}{2}$ e. None of these

10. If a substance decomposes at a rate proportional to the amount of the substance present, and if the amount decreases from 40 gm to 10 gm in 2 hours, then the constant of proportionality is:

a. $-\ln 2$ b. $-\frac{1}{2}$ c. $-\frac{1}{4}$ d. $\ln\frac{1}{4}$ e. $\ln\frac{1}{8}$

11. A cup of coffee at temperature 180°F is placed on a table in a room at 68°F. The differential equation for its temperature at time *t* is $\frac{dy}{dx} = -0.11(y-68)$; $y(0) = 180$. After 10 minutes, the temperature

(in °F) of the coffee is:

a. 96 b. 100 c. 105 d. 110 e. 115

12. Approximately how long does it take the temperature of the coffee in question 11 to drop to 75°F?

a. 10 min b. 15 min c. 18 min d. 20 min e. 25 min

13. According to Newton's law of cooling, the temperature of an object decreases at a rate proportional to the difference between its temperature and that of the surrounding air. Suppose a corpse at temperature 32°C arrives at a mortuary where the temperature is kept at 10°C. Then the differential equation satisfied by the temperature T of the corpse *t* hours later is:

a. $\frac{dT}{dt} = -k(T-10)$ b. $\frac{dT}{dt} = k(T-32)$ c. $\frac{dT}{dt} = 32e^{-kt}$

d. $\frac{dT}{dt} = -kT(T-10)$ e. $\frac{dT}{dt} = kT(T-32)$

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14. If the corpse in Question 13 cools to 27°C in 1 hour, then its temperature is given by the equation:

a. $T = 22e^{0.205t}$ b. $T = 10e^{1.163t}$ c. $T = 10 + 22e^{-0.258t}$

d. $T = 32e^{-0.169t}$ e. $T = 32 - 10e^{-0.093t}$

15. The population of a city increases continuously at a rate proportional, at any time, to the population at that time. The population doubles in 50 years. After 75 years, the ratio of the population *P* to the initial population P_0 is:

a. $\frac{9}{4}$ b. $\frac{5}{2}$ c. $\frac{4}{1}$ d. $\frac{2\sqrt{2}}{1}$ e. None of these