Show the integral used to solve each problem. Use your calculator to evaluate each integral.

1) A body moves along a straight line so that its velocity v at time t is given by $v = 4t^3 + 3t^2 + 5$. The distance it covers from t = 0 to t = 2 equals

**(A)** 34 **(B)** 55 **(C)** 24 **(D)** 44 **(E)** none of these

2) A particle moves along a line with velocity $v = 3t^2 - 6t$. The total distance traveled from t = 0 to t = 3 equals

**(A)** 9 **(B)** 4 **(C)** 2 **(D)** 16 **(E)** none of these

3) During the worst four hour period of a hurricane the wind velocity in mph is given by $v(t) = 5t - t^2 + 100$ where $0 \le t \le 4$. The average wind velocity during this period is (in mph):

**(A)** 10 **(B)** 100 **(C)** 102 **(D)** $104\frac{2}{3}$ **(E)** $108\frac{2}{3}$

4) A stone is thrown upward from the ground with an initial velocity of 96 ft/s . Its average velocity (given that a(t) = -32 ft/s$^2$) during the first 2 seconds is

**(A)** 16 ft/s **(B)** 32 ft/s **(C)** 64 ft/s **(D)** 80 ft/s **(E)** 96 ft/s

5) Suppose the current world population is 6 billion and the population t years from now is estimated to be $P(t) = 6e^{0.024t}$ . Based on this supposition, the average population of the world (in billions) over the next 25 years will be approximately :

**(A)** 6.75 **(B)** 7.2 **(C)** 7.8 **(D)** 8.2 **(E)** 9.0

6) The average area of all circles with radii between 2 and 5 inches is

**(A)** $7\pi$ **(B)** $11\ \pi$ **(C)** $13\pi$ **(D)** $\frac{29\pi}{2}$ **(E)** $17\ \pi$

7) What is the exact total area bounded by the curve $f(x) = x^3 - 4x^2 + 3x$ and the x-axis?

**(A)** -2.25 **(B)** 2.25 **(C)** 3 **(D)** $3\frac{1}{12}$ **(E)** none of these

8) Water is leaking from a tank at the rate of $(-0.1t^2 - 0.3t + 2)$ gal/hr. The total amount that will leak out (in gallons) in the next three hours is approximately:

**(A)** 1.00 **(B)** 2.08 **(C)** 3.13 **(D)** 3.48 **(E)** 3.75

9) A bacterial culture is growing at the rate of $1000e^{0.03t}$ bacteria in t hours. The total increase in bacterial population during the second hour is approximately:

**(A)** 46 **(B)** 956 **(C)** 1046 **(D)** 1061 **(E)** 2046

10) The population density of Winnipeg (which is located in the middle of the Canadien prairie) drops dramatically as distance from the center of town increases. This is shown in the following table:

| x= distance (in miles) from the center | 0 | 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|---|
| f(x) = density (hundreds of people per square mile) | 50 | 45 | 40 | 30 | 15 | 5 |

The population living within a 10 mile radius of the center is approximately

**(A)** 608500 **(B)** 650000 **(C)** 691200 **(D)** 702000 **(E)** 850000

11) If a factory continuously dumps pollutants into a river at the rate of $\frac{\sqrt{t}}{180}$ tons per day, then the amount dumped after 7 weeks (in tons) is approximately:

**(A)** 0.07 **(B)** 0.90 **(C)** 1.55 **(D)** 1.90 **(E)** 1.27

12) A rumor spreads through a town at the rate of $(t^2 + 10t)$ new people per day. Approximately how many people near the rumor during the second week after it was first heard?

**(A)** 1535 **(B)** 1894 **(C)** 2000 **(D)** 2219 **(E)** none of these

13) Oil is leaking from a tanker at the rate of $1000e^{-0.3t}$ gal/hr , where t is given in hours. A general Riemann sum for the amount of oil that leaks out in the next 8 hours, where the interval [0,8] has been partitioned into n subintervals is:

**(A)** $\sum_{k=1}^{n} e^{-0.3t_k} \Delta t$ **(B)** $\lim_{n\to\infty} \sum_{k=1}^{n} e^{-0.3t_k} \Delta t$ **(C)** $\lim_{n\to\infty} \sum_{k=1}^{n} 1000e^{-0.3t_k} \Delta t$

**(D)** $\sum_{k=1}^{n} 1000e^{-0.3t_k} \Delta t$ **(E)** $1000\sum_{k=1}^{n} e^{0.3t_k} \Delta t$

14) In question 13, the total number of gallons of oil that will leak out during the next 8 hours is approximately:

**(A)** 1271 **(B)** 3031 **(C)** 3161 **(D)** 4323 **(E)** 11023

15) Assume that the density of vehicles (number per mile) during morning rush hour for the 20 mile stretch along the New York State Thruway southbound from the Tappan Zee Bridge is given by $f(x)$, where x is the distance in miles south of the bridge. Which of the following gives the number of vehicles (on this 20 mile stretch) from the bridge to a point x miles south of the bridge?

**(A)** $\int_0^x f(x)dx$ **(B)** $\lim_{n\to\infty} \sum_{k=1}^{n} f(x_k)\Delta x$ **(C)** $\int_0^{20} f(x)dx$

**(D)** $\sum f(x_k)\Delta x$ **(E)** none of these