1. The following table gives the total undergraduate enrollment (in thousands) of Purdue University during the fall semester of the given year:

Year	2010	2011	2012	2013
Number Enrolled (thousands)	30.8	30.8	30.1	29.4

Find the least-squares line $y = mt + b$ for this data, where t is the number of years after 2010.

A. $y = -0.49t + 31.01$

B. $y = -0.09t + 5.74$

C. $y = -0.23t + 14.77$

D. $y = -0.23t + 31.01$

E. $y = -0.09t + 30.41$

2. Write the following infinite series in summation notation.

$$5 - \frac{7}{8} + \frac{9}{27} - \frac{11}{64} + \ldots$$

A. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n+1}\frac{2n+5}{n^3}$

B. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n+1}\frac{3n+2}{n^3}$

C. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n+1}\frac{2n+3}{n^3}$

D. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n}\frac{2n+3}{2^n}$

E. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n}\frac{2n+5}{2^n}$

3. Write a differential equation describing the following situation. The rate at which people become involved in a corporate bribing scheme is jointly proportional to the number of people already involved and the number of people who are not yet involved. Use k for the constant, P for the number of people who are involved in the scheme, t for time, and N for the total number of people in the company.

   A. $\frac{dP}{dt} = \frac{kP}{N-P}$
   B. $\frac{dP}{dt} = \frac{kP}{N}$
   C. $\frac{dP}{dt} = kPN$
   D. $\frac{dP}{dt} = kP(N-P)$
   E. $\frac{dP}{dt} = \frac{k}{P(N-P)}$

4. Determine which of the following series converge.

I. $\displaystyle\sum_{k=2}^{\infty} \frac{k^2}{5^k}$

II. $\displaystyle\sum_{k=3}^{\infty} \frac{(3k+1)\pi^{2k}}{10^{k+1}}$

III. $\displaystyle\sum_{k=1}^{\infty} \frac{k!}{(-2)^k}$

   A) III
   B) I & II
   C) I & III
   D) II & III
   E) II

5. Determine the interval of absolute convergence for the given power series.

$$\sum_{k=2}^{\infty} \frac{x^k}{5^k \ln k}$$

   A. $x = 0$
   B. $-\infty < x < \infty$
   C. $\frac{-1}{5} < x < \frac{1}{5}$
   D. $-5 < x < 5$
   E. $-1 < x < 1$

6. Find the general solution of the given differential equation.

$$\frac{dy}{dx} = \sqrt{y}e^{x+1}$$

A. $y = \left(C + \frac{(x+1)e^{x+1}}{2}\right)^2$

B. $y = \left(C + \frac{e^{x+1}}{2x}\right)^2$

C. $y = \left(C + \frac{e^{x+1}}{2}\right)^2$

D. $y = \left(C + \frac{xe^{x+1}}{2}\right)^2$

E. $y = \left(C + \frac{(x+1)e^{x+1}}{2x}\right)^2$

7. Evaluate the following double integral

$$\iint_R x^3 y \, dA$$

where R is the rectangle with vertices $(0,0)$, $(2,0)$, $(0,4)$, and $(2,4)$.

A. 8

B. 32

C. 64

D. $\dfrac{128}{3}$

E. 128

8. Use a degree 6 Taylor polynomial to estimate the definite integral.

$$\int_0^1 \frac{1}{1+2x^3}\,dx$$

A. $\frac{1}{2}$

B. $\frac{29}{14}$

C. $\frac{3}{2}$

D. $\frac{25}{28}$

E. $\frac{15}{14}$

9. A rectangular box with a square base is to be constructed from material that costs \$5/ft^2 for the bottom, \$3/ft^2 for the top, and \$2/ft^2 for the sides. Find the box of greatest volume that can be constructed for \$216.

A. 49.6 ft^3

B. 54 ft^3

C. 108 ft^3

D. 216 ft^3

E. 576 ft^3

10. The sum of the geometric series $\sum_{n=2}^{\infty} \frac{(-1)^n}{3^{n-2}}$ is:

A. $\frac{3}{2}$

B. $\frac{3}{4}$

C. $\frac{1}{12}$

D. $-\frac{3}{2}$

E. $-\frac{3}{4}$

11. In a certain island, at any given time, there are R hundred rats and S hundred snakes. Their populations are related by the equation:

$$(R-10)^2 + 16(S-5)^2 = 68.$$

What is the maximum combined number of snakes and rats that could ever be on this island at the same time?

A. 625

B. 2000

C. 2350

D. 2500

E. 3600

12. Evaluate the integral: $\int_{\frac{1}{2}}^{\frac{e}{2}} \int_0^{ln2x} \frac{1}{x} dydx$.

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. 0

D. e

E. $\frac{2e}{3}$

13. The minimum and maximum of $f(x,y) = y^2 - x^2 - 4x$, restricted to $\frac{1}{4}x^2 + \frac{1}{9}y^2 = 1$, rounded to the nearest integer, are, respectively:

A. -12 and 4

B. -12 and 10

C. 5 and 7

D. 5 and 10

E. 7 and 15

14. A patient is given an injection of 50 milligrams of a drug every 24 hours. After t days, the fraction of the drug remaining in the patient's body is

$$f(t) = 2^{-t/3}.$$

If the treatment is continued indefinitely, approximately how many milligrams of the drug will eventually be in the patient's body just prior to an injection?

A. 242.4

B. 305.4

C. 152.7

D. 192.4

E. 202.7

15. Find the Taylor series about $x = 0$ for the indefinite integral

$$\int xe^{-x^3}\,dx.$$

A. $\sum_{n=0}^{\infty} \frac{(-1)^n}{n!(3n+1)} x^{3n+1} + C$

B. $\sum_{n=0}^{\infty} \frac{1}{n!(3n+1)} x^{3n+2} + C$

C. $\sum_{n=0}^{\infty} \frac{1}{n!(3n+2)} x^{3n+2} + C$

D. $\sum_{n=0}^{\infty} \frac{(-1)^n}{n!(3n+1)} x^{3n+2} + C$

E. $\sum_{n=0}^{\infty} \frac{(-1)^n}{n!(3n+2)} x^{3n+2} + C$