1.(1 pt) Evaluate the following expressions.
(a) $\log_2\left(\frac{1}{32}\right) =$ ______
(b) $\log_5 1 =$ ______
(c) $\log_4 \sqrt{64} =$ ______
(d) $5^{\log_5 8} =$ ______

2.(1 pt) Evaluate the following expressions.
(a) $\ln e^{-1} =$ ______
(b) $e^{\ln 4} =$ ______
(c) $e^{\ln\sqrt{4}} =$ ______
(d) $\ln(1/e^3) =$ ______

3.(1 pt) Solve the given equation for x.
$6^{4x-4} = 46$ ______

4.(1 pt)
If $\ln(4x+4) = 2$, then $x =$ ______ .

5.(1 pt) If $e^{5x} = 19$, then $x =$ ______ .

6.(1 pt)

$$\ln(r^2 s^6 \sqrt[3]{r^4 s^5})$$

is equal to

$$A \ln r + B \ln s$$

where $A =$ ______ and where $B =$ ______

7.(1 pt) The equation $e^{2x} - 10e^x + 24 = 0$ has two solutions.
The smaller one is: ______
and the larger one is: ______ .

8.(1 pt) Let $f(x) = \ln(\cos x)$. Assume that x is restricted so that ln is defined. Find

$$f'\left(\frac{\pi}{2}\right).$$

Answer: ______

9.(1 pt) Find the integral

$$\int_0^1 \frac{t+1}{2t^2+4t+3}\,dt.$$

Answer: ______

10.(1 pt) Suppose

$$y = (x^2+3x)(x-2)(x^2+1).$$

Find $\frac{dy}{dx}$ by logarithmic differentiation. See Example 7 in Section 7.1 of your text.
Answer: ______

11.(1 pt) The rate of transmission in a telegraph cable is observed to be proportional to $x^2 \ln(1/x)$, where x is the ratio of the radius of the core to the thickness of the insulation ($0 < x < 1$). What value of x gives the maximum rate of transmission?
Answer: ______

12.(1 pt) Evaluate

$$\int_0^{\pi/3} \tan x\,dx.$$

Answer: ______

13.(1 pt) A ball is thrown vertically upward with initial velocity v. Find the maximum height H of the ball as a function of v. Then find the initial velocity v required to achieve a height of H.
Height H achieved with given initial velocity v: ______
Initial velocity v required to achieve given height H: ______ .

14.(1 pt) Suppose $y = e^{1/x^2} + 1/e^{x^2}$. Find $D_x y$.
$D_x y =$ ______

15.(1 pt) Suppose $e^{x+y} = x+y$. Find $D_x y$.
$D_x y =$ ______

16.(1 pt) Find the integral

$$\int \frac{e^x}{e^x - 1}\,dx.$$

Answer: ______ $+C$.

17.(1 pt) Find the integral

$$\int_1^2 \frac{e^{3/x}}{x^2}\,dx.$$

Answer: ______

18.(1 pt) The region bounded by $y = e^{-x^2}$, $y = 0$, $x = 0$, and $x = 1$ is revolved about the y-axis. Find the volume of the resulting solid.
Answer: ______

19.(1 pt) Let $f(x) = \dfrac{\ln x}{1+(\ln x)^2}$ for x in $(0,\infty)$. Find
a) $\lim_{x\to 0^+} f(x) =$ ______
b) $\lim_{x\to\infty} f(x) =$ ______

20.(1 pt) Evaluate the following limit:

$$\lim_{x\to 0}(1+x)^{1/x}.$$

Answer: ______________________________

21.(1 pt) Suppose $y = \sin^2 x + 2^{\sin x}$. Find dy/dx.

Answer: ______________________________

22.(1 pt) The loudness of sound is measured in decibels in honor of Alexander Graham Bell (1847-1922), inventor of the telephone. If the variation in pressure is P pounds per square inch, then the loudness L in decibels is

$$L = 20\log_{10}(121.3P).$$

Find the variation in pressure caused by a rock band at 115 decibels.

Answer: ______________ pounds per square inch.

1.(1 pt)

A certain bacteria population is known to triple every 30 minutes. Suppose that there are initially 200 bacteria.

What is the size of the population after t hours? ___

2.(1 pt) If a bacteria culture starts with 8000 bateria and doubles every 30 minutes, how many minutes will it take the population to reach 42000? ______

3.(1 pt) The count in a bacteria culture was 400 after 20 minutes and 1900 after 30 minutes. What was the initial size of the culture? ___ Find the doubling period. ___ Find the population after 70 minutes. ___ When will the population reach 14000? ______

4.(1 pt)

The rat population in a major metropolitan city is given by the formula $n(t) = 87e^{0.01t}$ where t is measured in years since 1994 and $n(t)$ is measured in millions.

What was the rat population in 1994 ? ______

What is the rat population going to be in the year 2006 ? ______

5.(1 pt) The half-life of Radium-226 is 1590 years. If a sample contains 200 mg, how many mg will remain after 1000 years? ______

6.(1 pt) If 4000 dollars is invested in a bank account at an interest rate of 5 per cent per year, find the amount in the bank after 13 years if interest is compounded annually ______
Find the amount in the bank after 13 years if interest is compounded quaterly ______
Find the amount in the bank after 13 years if interest is compounded monthly ______
Finally, find the amount in the bank after 13 years if interest is compounded continuously ______

7.(1 pt) The 1906 San Francisco earthquake had a magnitude of 8.3 on the Richter scale. At the same time in South America there was an eathquake with magnitude 5.3 that caused only minor damage. How many times more intense was the San Francisco earthquake than the South American one?

The magnitude M on the Richter scale of an earthquake as a function of its intensity I is given by

$$M = \log_{10}\left(\frac{I}{I_0}\right),$$

where I_0 is some fixed reference level of intensity.

Answer: ______

8.(1 pt) Human hair from a grave in Africa proved to have only 63% of the carbon 14 of living tissue. When was the body buried? See Problem 13 of Section 7.5 of the course text.

The body was buried about ______ years ago.

9.(1 pt) **Newton's Law of Cooling** states that the rate at which an object cools is proportional to the difference in temperature between the object and the surrounding medium. Thus, if an object is taken from an oven at 307°F and left to cool in a room at 70°F, its temperature T after t hours will satisfy the differential equation

$$\frac{dT}{dt} = k(T-70).$$

If the temperature fell to 198°F in 0.7 hour(s), what will it be after 3 hour(s)?

After 3 hour(s), the temperature will be ___ °F.

10.(1 pt) Inflation between 1977 and 1981 ran at about 10.5% per year. On this basis, what would you expect a car that would have cost $4800 in 1977 to cost in 1981?

Answer: ______ .

11.(1 pt) Assume that (1) world population continues to grow exponentially with growth constant $k = 0.0132$, (2) it takes $\frac{1}{2}$ acre of land to supply food for one person, and (3) there are 13,500,000 square miles of arable land in in the world. How long will it be before the world reaches the maximum population? Note: There were 6.06 billion people in the year 2000 and 1 square mile is 640 acres.

Answer: Maximum population will be reached some time in the year ______ .

12.(1 pt) Use the fact that

$$e = \lim_{h\to 0}(1+h)^{1/h}$$

to find the following limits:

(a) $\lim_{x\to 0}(1-x)^{1/2x} =$ ______

(b) $\lim_{x\to 0}(1+7x)^{1/x}=$ ______

(c) $\lim_{n\to\infty}\left(\frac{n+9}{n}\right)^{n}=$ ______

(d) $\lim_{n\to\infty}\left(\frac{n-7}{n}\right)^{2n}=$ ______

13.(1 pt) Solve the following differential equation:

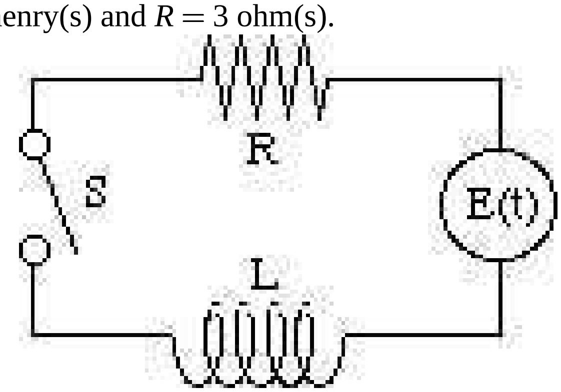
$$y'+y\tan x=\sec x.$$

Instruction: Name your integration constant C.
Answer: ______ .

14.(1 pt) A tank initially contains 200 gallons of brine, with 50 pounds of salt in solution. Brine containing 2 pounds of salt per gallon is entering the tank at the rate of 4 gallons per minute and is flowing out at the same rate. If the mixture in the tank is kept uniform by constant stirring, find the amount of salt in the tank at the end of 40 minutes.

Amount of salt after 40 minutes: ______ pound(s).

15.(1 pt) Find the current I as a function of time for the circuit in the following figure if the switch S is closed and $I=0$ at $t=0$, where $E=5$ volt(s), $L=3$ henry(s) and $R=3$ ohm(s).



(**Click on image for a larger view**)
Answer: ______ .

16.(1 pt) Megan bailed out of her plane at an altitude of 8000 feet, fell freely for 15 seconds, and then opened her parachute. Assume that the drag coefficients are $a=0.1$ for a fee fall and $a=1.6$ with a parachute. When did she land?

Answer: It takes Megan about ______ seconds to reach the ground.

17.(1 pt) Let

$$f(x)=x^2\tan^{-1}(2x)$$

$f'(x)=$ ______

NOTE: The WeBWorK system will accept $\arctan(x)$ but not $\tan^{-1}(x)$ as the inverse of $\tan(x)$.

18.(1 pt) Let

$$f(x)=7\cos(x)\sin^{-1}(x)$$

$f'(x)=$ ______

NOTE: The webwork system will accept $\arcsin(x)$ and not $\sin^{-1}(x)$ as the inverse of $\sin(x)$.

19.(1 pt) Find the limit

$$\lim_{x\to\infty}\sec^{-1}x$$

Answer: ______ .

20.(1 pt) Evaluate the integral:

$$\int_{\sqrt{2}}^{2}\frac{dx}{x\sqrt{x^2-1}}$$

Answer: ______ .

21.(1 pt) Evaluate the integral:

$$\int_0^{\pi/2}\frac{\sin\theta}{1+\cos^2\theta}d\theta$$

Answer: ______ .

22.(1 pt) Suppose $y=\sinh(x^2+x)$. Find D_xy.
Answer: $D_xy=$ ______ .

23.(1 pt) Suppose $y=\ln(\coth x)$. Find D_xy.
Answer: $D_xy=$ ______ .

24.(1 pt) Evaluate the integral

$$\int\frac{\cosh\sqrt{z}}{\sqrt{z}}\,dz$$

Answer: ______ + C.

25.(1 pt) The curve $y=\sinh x, 0\le x\le 1$, is revolved about the x-axis. Find the area of the resulting surface.
Answer: ______ .

1.(1 pt) Perform the following integration:

$$\int \frac{\sin(4t-1)}{1-\sin^2(4t-1)}\,dt$$

Answer: ______________________ $+C$.

2.(1 pt) Perform the following integration:

$$\int e^x \sec^2(e^x)\,dx$$

Answer: ______________________ $+C$.

3.(1 pt) Perform the following integration:

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

Answer: ______________________ .

4.(1 pt) Perform the following integration:

$$\int \frac{1}{x^2-4x+9}\,dx$$

Answer: ______________________ $+C$.

5.(1 pt) Perform the following integration:

$$\int \frac{\sqrt{x^2+2x-3}}{x+1}\,dx$$

Answer: ______________________ $+C$.

6.(1 pt) Perform the following integration:

$$\int \frac{\sin x}{(\cos x)\sqrt{5-4\cos x}}\,dx$$

Answer: ______________________ $+C$.

7.(1 pt) Perform the following integration:

$$\int \cos^3 x\,dx$$

Answer: ______________________ $+C$.

8.(1 pt) Integrals of the form $\int \cot^n x dx$ can be evaluated by factoring out $\cot^2 x = \csc^2 x - 1$. Use this method to evaluate the following integral:

$$\int \cot^4 x\,dx$$

Answer: ______________________ $+C$.

9.(1 pt) When n is even, integrals of the form $\int \tan^m x \sec^n x\,dx$ can be evaluated by factoring out $\sec^2 x = 1+\tan^2 x$ and using the fact that $D_x \tan x = \sec^2 x$. When m is odd, integrals of this form can be evaluated by factoring out $\tan x \sec x$ and using the fact that $D_x \sec x = \sec x \tan x$. Use this method to evaluate the following integral:

$$\int \tan^{-3/2} x \sec^4 x\,dx$$

Answer: ______________________ $+C$.

10.(1 pt) Evaluate the following integral:

$$\int_{-L}^{L} \cos\frac{m\pi x}{L}\cos\frac{n\pi x}{L}\,dx,$$

where $m \neq n$ and m, n are integers.

Answer: ______________________ .

11.(1 pt) Evaluate the following integral:

$$\int_0^1 \frac{\sqrt{t}}{t+1}\,dt$$

Answer: ______________________ .

12.(1 pt) Perform the following integration:

$$\int \frac{x^2}{\sqrt{16-x^2}}\,dx$$

Answer: ______________________ $+C$.

13.(1 pt) Perform the following integration:

$$\int \frac{2x-1}{\sqrt{x^2+4x+5}}\,dx$$

Answer: ______________________ $+C$.

14.(1 pt) The region bounded by $y = 1/(x^2+2x+5)$, $y=0$, $x=0$, and $x=1$, is revolved about the y-axis. Find the volume of the resulting solid.

Answer: ______________________ .

1.(1 pt) Use integration by parts to evaluate the following integral:

$$\int (t+7)e^{2t+3}\,dt$$

Answer: ______________________ $+C$.

2.(1 pt) Use integration by parts to evaluate the following integral:

$$\int \arctan 5x\,dx$$

Answer: ______________________ $+C$.

3.(1 pt) Use integration by parts to evaluate the following integral:

$$\int \sec^3 x\,dx$$

Answer: ______________________ $+C$.

4.(1 pt) Use integration by parts twice to evaluate the following integral:

$$\int \cos(\ln x)\,dx$$

Answer: ______________________ $+C$.

5.(1 pt) Find the volume of the solid obtained by revolving the region under the graph of $y=\sin(x/2)$ from $x=0$ to $x=2\pi$ about the y-axis.

Answer: ______________________ .

6.(1 pt) Use the method of partial fraction decomposition to perform the following integration:

$$\int \frac{x-7}{x^2-x-12}\,dx$$

Answer: ______________________ $+C$.

7.(1 pt) Use the method of partial fraction decomposition to perform the following integration:

$$\int \frac{2x^2-x-20}{x^2+x-6}\,dx$$

Answer: ______________________ $+C$.

8.(1 pt) Use the method of partial fraction decomposition to perform the following integration:

$$\int \frac{5x+7}{x^2+4x+4}\,dx$$

Answer: ______________________ $+C$.

9.(1 pt) Use the method of partial fraction decomposition to perform the following integration:

$$\int \frac{1}{x^4-16}\,dx$$

Answer: ______________________ $+C$.

10.(1 pt) In many population growth problems, there is an upper limit beyond which the population cannot grow. Let us suppose that the earth will not support a population of more than 16 billion and that there were 2 billion people in 1925 and 4 billion people in 1975. Then, if y is the population t years after 1925, an appropriate model is the differential equation

$$\frac{dy}{dt}=ky(16-y).$$

(a) Solve this differential equation.
Solution: $y(t)$ = ______________________ .
(b) Find the population in 2015.
Population in 2015: ______________ billion
(c) When will the population be 9 billion?
The year the population will be 9 billion: _____ .

11.(1 pt) Find the following limit using l'Hopital's Rule:

$$\lim_{x\to 1}\frac{\ln x^2}{x^2-1}$$

Answer: ______________________ .

12.(1 pt) Find the following limit using l'Hopital's Rule:

$$\lim_{x\to 0^-}\frac{3\sin x}{\sqrt{-x}}$$

Answer: ______________________ .

13.(1 pt) Find the following limit using l'Hopital's Rule:

$$\lim_{x\to 0^+}\frac{\int_0^x \sqrt{t}\cos t\,dt}{x^2}$$

Answer: ______________________ .
Enter the word "infinity" if the answer is ∞.

14.(1 pt) Find the following limit using l'Hopital's Rule:

$$\lim_{x\to\infty} \frac{3x}{\ln(100x+e^x)}$$

Answer: ______________________________ .

15.(1 pt) Find the following limit using l'Hopital's Rule:

$$\lim_{x\to 0} 3x^2 \csc^2 x$$

Answer: ______________________________ .

16.(1 pt) Find the following limit using l'Hopital's Rule:

$$\lim_{x\to 0} (\cos x)^{1/x^2}$$

Answer: ______________________________ .

17.(1 pt) Find the following limit using l'Hopital's Rule:

$$\lim_{x\to 0^+} (x^{1/2} \ln x)$$

Answer: ______________________________ .

18.(1 pt) Find the following limit:

$$\lim_{x\to 0^+} x^x$$

Answer: ______________________________ .

19.(1 pt) Find the following limit:

$$\lim_{x\to 0^+} (x^x)^x$$

Answer: ______________________________ .

20.(1 pt) Evaluate the following improper integral:

$$\int_{-\infty}^{1} e^{4x}\, dx$$

Answer: ______________________________ .

If the integral diverges, enter "diverge" as answer.

21.(1 pt) Evaluate the following improper integral:

$$\int_{10}^{\infty} \frac{x}{1+x^2}\, dx$$

Answer: ______________________________ .

If the integral diverges, enter "diverge" as answer.

22.(1 pt) Evaluate the following improper integral:

$$\int_{e}^{\infty} \frac{\ln x}{x}\, dx$$

Answer: ______________________________ .

If the integral diverges, enter "diverge" as answer.

23.(1 pt) Evaluate the following improper integral:

$$\int_{1}^{\infty} xe^{-x}\, dx$$

Answer: ______________________________ .

If the integral diverges, enter "diverge" as answer.

24.(1 pt) Evaluate the following improper integral:

$$\int_{4}^{\infty} \frac{1}{(\pi-x)^{2/3}}\, dx$$

Answer: ______________________________ .

If the integral diverges, enter "diverge" as answer.

25.(1 pt) Find the area of the region under the curve

$$y = \frac{1}{x^2+x}$$

to the right of $x = 1$.

Answer: ______________________________ .

1.(1 pt) Evaluate the following improper integral. If the integral is divergent, enter "divergent" as answer.

$$\int_5^{-5} \frac{1}{x^{2/3}}\,dx$$

Answer: ____________ .

2.(1 pt) Evaluate the following improper integral. If the integral is divergent, enter "divergent" as answer.

$$\int_0^{1} \frac{x}{\sqrt[3]{1-x^2}}\,dx$$

Answer: ____________ .

3.(1 pt) Evaluate the following improper integral. If the integral is divergent, enter "divergent" as answer.

$$\int_0^{\pi/2} \csc x\,dx$$

Answer: ____________ .

4.(1 pt) Evaluate the following improper integral. If the integral is divergent, enter "divergent" as answer.

$$\int_{-3}^{-1} \frac{1}{x\sqrt{\ln(-x)}}\,dx$$

Answer: ____________ .

5.(1 pt) Evaluate the following improper integral. If the integral is divergent, enter "divergent" as answer.

$$\int_1^{10} \frac{1}{x\ln^{100} x}\,dx$$

Answer: ____________ .

6.(1 pt) Evaluate the following improper integral. If the integral is divergent, enter "divergent" as answer.

$$\int_{-1}^{1} \frac{1}{x\sqrt{-\ln|x|}}\,dx$$

Answer: ____________ .

7.(1 pt) Consider the sequence

$$a_n = \frac{n\cos(n\pi)}{2n-1}.$$

Write the first five terms of a_n, and find $\lim_{n\to\infty} a_n$. If the sequence diverges, enter "divergent" in the answer box for its limit.

a) First five terms: ___ ,___ ,___ ,___ ,___ .

b) $\lim_{n\to\infty} a_n =$ ____________ .

8.(1 pt) Consider the sequence

$$a_n = \frac{\ln(1/n)}{\sqrt{2n}}.$$

Write the first five terms of a_n, and find $\lim_{n\to\infty} a_n$. If the sequence diverges, enter "divergent" in the answer box for its limit.

a) First five terms: ___ ,___ ,___ ,___ ,___ .

b) $\lim_{n\to\infty} a_n =$ ____________ .

9.(1 pt) Suppose

$$a_1 = \frac{1}{2-\frac{1}{2}}, a_2 = \frac{2}{3-\frac{1}{3}}, a_3 = \frac{3}{4-\frac{1}{4}}, a_4 = \frac{4}{5-\frac{1}{5}}, a_5 = \frac{5}{6-\frac{1}{6}}.$$

a) Find an explicit formula for a_n: ____________ .

b) Determine whether the sequence is convergent or divergent: ____________ .

(Enter "convergent" or "divergent" as appropriate.)

c) If it converges, find $\lim_{n\to\infty} a_n =$ ____________ .

10.(1 pt) Suppose

$$a_1 = 2, a_{n+1} = \frac{1}{2}\left(a_n + \frac{2}{a_n}\right).$$

Find $\lim_{n\to\infty} a_n =$ ____________ .

Hint: Let $a = \lim_{n\to\infty}$. Then, since $a_{n+1} = \frac{1}{2}\left(a_n + \frac{2}{a_n}\right)$, we have $a = \frac{1}{2}\left(a + \frac{2}{a}\right)$. Now solve for a.

11.(1 pt) Consider the series:

$$\sum_{k=1}^{\infty} \left[5\left(\frac{1}{2}\right)^k - 3\left(\frac{1}{7}\right)^{k+1}\right]$$

a) Determine whether the series is convergent or divergent: ____________ .

(Enter "convergent" or "divergent" as appropriate.)

b) If it converges, find its sum: ______ .
If the series diverges, enter here "divergent" again.

12.(1 pt) Consider the series:

$$\sum_{k=1}^{\infty} \frac{3}{k}.$$

a) Determine whether the series is convergent or divergent: ______ .
(Enter "convergent" or "divergent" as appropriate.)
b) If it converges, find its sum: ______ .
If the series diverges, enter here "divergent" again.

13.(1 pt) Consider the series:

$$\sum_{k=1}^{\infty} \frac{2}{k(k+2)}.$$

a) Determine whether the series is convergent or divergent: ______ .
(Enter "convergent" or "divergent" as appropriate.)
b) If it converges, find its sum: ______ .
If the series diverges, enter here "divergent" again.

14.(1 pt) Consider the series:

$$\sum_{k=10}^{\infty} \left(\frac{3}{(k-1)^2} - \frac{3}{k^2} \right)$$

a) Determine whether the series is convergent or divergent: ______ .
(Enter "convergent" or "divergent" as appropriate.)
b) If it converges, find its sum: ______ .
If the series diverges, enter here "divergent" again.

15.(1 pt)
A ball is dropped from a height of 103 feet. Each time it hits the floor, it rebounds to $\frac{3}{4}$ its previous height. Find the total distance it travels before coming to rest.
Answer: ______ feet.

16.(1 pt)
How large must N be in order for

$$S_N = \sum_{k=1}^{N} \frac{1}{k}$$

to exceed 4? Note: Computer calculations show that for S_N to exceed 20, $N = 272,400,600$ and for S_N to exceed 100, $N \approx 1.5 \times 10^{43}$.
Answer: $N =$ ______ .

17.(1 pt)
Use the Integral Test to decide the convergence or divergence of the following series:

$$\sum_{k=1}^{\infty} \frac{k^2}{e^k}.$$

Answer: ______ (Enter "converge" or "diverge".)

18.(1 pt)
Use the Integral Test to decide the convergence or divergence of the following series:

$$\sum_{k=1}^{\infty} \frac{1000k^2}{1+k^3}.$$

Answer: ___ (Enter "convergent" or "divergent".)

19.(1 pt)
Use the Integral Test to decide the convergence or divergence of the following series:

$$\sum_{k=5}^{\infty} \frac{1000}{k(\ln k)^2}.$$

Answer: ___ (Enter "convergent" or "divergent".)

20.(1 pt)
Decide the convergence or divergence of the following series:

$$\sum_{k=1}^{\infty} \left(\frac{3}{\pi}\right)^k.$$

Answer: ___ (Enter "convergent" or "divergent".)

21.(1 pt)
Decide the convergence or divergence of the following series:

$$\sum_{k=1}^{\infty} \left(\frac{1}{k} - \frac{1}{k+1}\right).$$

Answer: ___ (Enter "convergent" or "divergent".)

22.(1 pt)
Decide the convergence or divergence of the following series:

$$\sum_{n=3}^{\infty} \frac{1}{n \cdot \ln n \cdot \ln(\ln n)}.$$

Answer: ___ (Enter "convergent" or "divergent".)

1.(1 pt) Determine the convergence or divergence of the following series.

$$\sum_{n=1}^{\infty} \frac{\sqrt{2n+1}}{n^2}$$

- A. convergent
- B. divergent

2.(1 pt) Determine the convergence or divergence of the following series.

$$\sum_{n=1}^{\infty} \frac{3^k+k}{k!}$$

- A. convergent
- B. divergent

3.(1 pt) Determine the convergence or divergence of the following series.

$$\sum_{n=1}^{\infty} \frac{5^{2n}}{n!}$$

- A. convergent
- B. divergent

4.(1 pt) Determine the convergence or divergence of the following series.

$$\sum_{n=1}^{\infty} \sqrt{n}\left[1-\cos\left(\frac{1}{n}\right)\right]$$

- A. convergent
- B. divergent

5.(1 pt) Determine whether the following series is

$$\sum_{n=1}^{\infty} (-1)^{n+1}\frac{1}{5n^{1.1}}$$

- A. absolutely convergent
- B. conditionally convergent
- C. divergent

6.(1 pt) Determine whether the following series is

$$\sum_{n=2}^{\infty} (-1)^{n}\frac{1}{\sqrt{n^2-1}}$$

- A. conditionally convergent
- B. absolutely convergent
- C. divergent

7.(1 pt) Determine whether the following series is

$$\sum_{n=1}^{\infty} (-1)^{n}\frac{\sin n}{n\sqrt{n}}$$

- A. absolutely convergent
- B. conditionally convergent
- C. divergent

8.(1 pt) Find the convergence set of the given power series:

$$\sum_{n=1}^{\infty} \frac{2^n x^n}{n!}$$

The above series converges for ___ $< x <$ ___ .
Enter "infinity" for ∞ and "-infinity" for $-\infty$.

9.(1 pt) Find the convergence set of the given power series:

$$\sum_{n=1}^{\infty} \frac{(x-2)^n}{n^2}$$

The above series converges for ___ $\le x \le$ ___ .
Enter "infinity" for ∞ and "-infinity" for $-\infty$.

10.(1 pt) A famous sequence f_n, called the Fibonacci Sequence after Leonardo Fibonacci, who introduced it around A.D. 1200, is defined by the recursion formula

$$f_1 = f_2 = 1, \quad f_{n+2} = f_{n+1} + f_n.$$

Find the radius of convergence of

$$\sum_{n=1}^{\infty} f_n x^n.$$

Radius of convergence: ________ .

11.(1 pt) Find the power series representation for

$$f(x) = \frac{1}{(1+x)^2}$$

and specify the radius of convergence.

$$f(x) = \sum_{n=1}^{\infty} (-1)^{e_n} a_n x^{p_n},$$

where $e_n =$ ____________________ ,
where $a_n =$ ____________________ ,
and $p_n =$ ____________________ .
Radius of convergence: ____________ .

12.(1 pt) Find the power series representation for

$$f(x) = xe^{x^2}.$$

$$f(x) = \sum_{n=0}^{\infty} \frac{1}{a_n!} x^{p_n},$$

where $a_n =$ ________ and $p_n =$ ________ .

13.(1 pt) Find the power series representation for

$$f(x) = \int_0^x \frac{\tan^{-1} t}{t}\, dt.$$

$$f(x) = \sum_{n=1}^{\infty} (-1)^{e_n} a_n x^{p_n},$$

where $e_n =$ ____________________ ,
and $a_n =$ ____________________ ,
and $p_n =$ ____________________ .

14.(1 pt) Find the sum of
$\sum_{n=1}^{\infty} n(n+1)x^n =$ ____________________
for __________ $< x <$ __________ .

15.(1 pt) Find the terms through x^5 in the Maclaurin series for

$$f(x) = e^{-x} \cos x.$$

$f(x) =$ ____________________ $+O(x^6)$.

16.(1 pt) Find the terms through x^5 in the Maclaurin series for

$$f(x) = \frac{1}{1-\sin x}.$$

$f(x) =$ ____________________ $+O(x^6)$.

17.(1 pt) Find the Taylor series in $(x-a)$ through $(x-a)^3$ for

$$f(x) = \tan x, \quad a = \frac{\pi}{4}$$

$f(x) =$ ___ $+$ ___ $\left(x-\frac{\pi}{4}\right)+$ ___ $\left(x-\frac{\pi}{4}\right)^2+$ ___ $\left(x-\frac{\pi}{4}\right)^3 + O\left(\left(x-\frac{\pi}{4}\right)^4\right)$.

18.(1 pt) Find the Taylor series in $(x-a)$ through $(x-a)^3$ for

$$f(x) = 2 - x + 3x^2 - x^3, \quad a = -1$$

$f(x) =$ ___ $+$ ___ $(x+1)+$ ___ $(x+1)^2+$ ___ $(x+1)^3$.

19.(1 pt) Calculate the following integral, accurate to five decimal places:

$$\int_0^{0.5} \sin\sqrt{x}\, dx$$

Answer: ____________________

1.(1 pt) Solve the following differential equation:

$$y'' - 3y' - 10y = 0; \quad y = 1, y' = 10 \text{ at } x = 0$$

Answer: $y(x) =$ ______ .

2.(1 pt) Solve the following differential equation:

$$y'' + 10y' + 25y = 0$$

Answer: $y(x) = C_1$ ______ $+C_2$ ______ .

3.(1 pt) Solve the following differential equation:

$$y'' + 9y = 0; \quad y = 3,\ y' = 3 \text{ at } x = \pi/3$$

Answer: $y(x) =$ ______ .

4.(1 pt) Solve the following differential equation:

$$y'' + y' + y = 0$$

Answer: $y(x) = C_1$ ______ $+C_2$ ______ .

5.(1 pt) Solve the following differential equation:

$$y'' - 2y' + 2y = 0$$

and express your answer in the form

$$ce^{\alpha x}\sin(\beta x + \gamma)$$

Answer: $\alpha =$ ______ , $\beta =$ ______ .

6.(1 pt) Use the method of undetermined coefficients to solve the following differential equation:

$$y'' + y' = 4x$$

Answer: $y(x) =$ ______ $+C_1$ ______ $+C_2$ ______ .

7.(1 pt) Use the method of undetermined coefficients to solve the following differential equation:

$$y'' + 6y' + 9y = 2e^{-x}$$

Answer: $y(x) =$ ______ $+C_1$ ______ $+C_2$ ______ .

8.(1 pt) Use the method of undetermined coefficients to solve the following differential equation:

$$y'' + 4y' = \cos x$$

Answer: $y(x) =$ ______ $+C_1$ ______ $+C_2$ ______ .

9.(1 pt) Solve the following differential equation:

$$y'' + 4y = \sin^3 x$$

Answer: $y(x) =$ ______ $+C_1$ ______ $+C_2$ ______ .

10.(1 pt) A spring with a spring constant k of 100 pounds per foot is loaded with 1-pound weight and brought to equilibrium. It is then stretched an additional 1 inch and released. Find the equation of motion, the amplitude, and the period. Neglect friction.

$y(t) =$ ______ ,
where t is time and $y(t)$ is displacement in time.

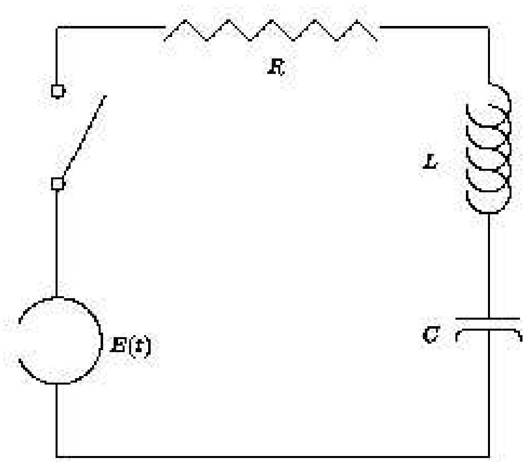
Amplitude: ______ inch(es)

Period: ______ second(s).

11.(1 pt) A spring with a spring constant k of 20 pounds per foot is loaded with a 10-pound weight and allowed to reach equilibrium. It is then displaced 1 foot downward and released. If the weight experiences a retarding force in pounds equal to four times the velocity at every point, find the equation of motion.

$y(t) =$ ______ ,
where t is time and $y(t)$ is displacement in time.

12.(1 pt) Using the following figure, find the steady-state current as a function of time; that is find a formula for I that is valid when t is very large ($t \to \infty$).



where $E(t) = 127\sin(387t)$, $R = 1004\,\Omega$, $L = 3.3\,\text{H}$, $C = 5 \times 10^{-6}\,\text{F}$.

For large t, $I(t) \approx$ ______ .

13.(1 pt) The equation that describes the motion of a pendulum supported by a massless rod is:

$$\frac{d^2\theta}{dt^2} + \frac{g}{L}\sin\theta = 0,$$

where t is time, $\theta(t)$ is the angle the pendulum makes with the vertical as a function of time, L is the length of the rod, and $g = GM/R^2$, where G is the universal gravitational constant, M is the mass of the earth, and R is the distance from the pendulum to the center of the earth.

The above equation is nonlinear, and for small θ, it is customary to approximate it by the equation:

$$\frac{d^2\theta}{dt^2} + \frac{g}{L}\theta = 0,$$

Two clocks, with pendulums of length L_1 and L_2 and located at distances R_1 and R_2 from the center of the earth have periods p_1 and p_2, respectively.

(a) Show that

$$\frac{p_1}{p_2} = \frac{R_1\sqrt{L_1}}{R_2\sqrt{L_2}}.$$

(This part of the problem will not be graded by WeBWorK.)

(b) Find the height of the mountain if a clock that kept perfect time at sea level (R = 3960 miles) with $L = 81$ inches had to have its pendulum shortened to $L = 80.85$ inches to keep perfect time at the top of the mountain.

Height of mountain: ____________________ miles.