1. Given $f''(x) = 5x - 6$ and $f'(-1) = 3$ and $f(-1) = -6$.

(2) (a) Find $f'(x) =$

(2) (b) Find $f(2) =$

(4) 2. Use the Simpson's Rule to estimate the value of the integral $\int_5^{11} f(x)\,dx$. Use all the data in the table and give your answer to 4 decimals. Hint: $n = 6$.

x	f(x)
5	2
6	5
7	3
8	2
9	0
10	-3
11	-5

(4) 3. Determine the equation of the tangent line to the curve at the specified point: $y = \dfrac{-e^x}{x}$, $(1, -e)$

4. Find $\dfrac{dy}{dx}$ for the following. **Do not simplify your answer.**

(4) (a) $\arctan(xy) = 1 + x^3 y$

(4) (b) $y = \arcsin(2x + 1) + \sec^{-1}(5x)$

(4) (c) $y = \ln(\sin\sqrt{x}) + x^3 \cos x$

(4) (d) $y = e^{\tan 3x} + \cot^3 x$

(4) (e) $y = \dfrac{\log_7(\sec x)}{3^x}$

(4) 5. Use Newton's method on the following function $f(x)$ and initial approximation x_1 to find x_3, the third approximation to the root of the equation. Given,

$f(x) = x^3 + 2x - 4, \qquad x_1 = 1$

(4) 6. When two electric resistors R_1 and R_2 are in series, their total resistance (the sum) is 32 Ω . If the same resistors are in parallel, their total resistance (the reciprocal of which equals the sum of the reciprocals of the individual resistances) is the maximum posible for two such resistors. What is the resistance of each?

(4) 7. Use the **Washer Method** to setup the integral needed to find the volume generated by revolving the region bounded by $x = \dfrac{y^2}{2}$, $x = y + 4$ and $y = 0$ about the y-axis. **DO NOT SOLVE THE INTEGRAL.**

(4) 8. Sketch the region enclosed by the given curves $y_1 = x^2$, $y_2 = 3x + 4$ and find its area.

(4) 9. Solve the given differential equation, $\cos^2 x + y \csc x \frac{dy}{dx} = 0$.

(4) 10. Find the Fourier series for the square wave function

$$f(x) = \begin{cases} -1, & \text{if } -\pi \le x < 0 \\ 1, & \text{if } 0 \le x < \pi \end{cases}$$

(4) 11. Solve the given first order differential equation, $y' + 2y = \sin x$.

(4) 12. A current $i = \dfrac{t}{\sqrt{t^2+1}}$ (in A) is sent through an electric dryer circuit containing a previously uncharged $2.0\mu F$ capacitor. How long does it take for the capacitor voltage to reach 120 V ?

13. Integrate the following integrals.

(4) (a) $y = \displaystyle\int \tan^9 x \sec^2 x \, dx$

(4) (b) $y = \displaystyle\int_1^e \frac{\cos(\ln x)}{x} \, dx$

(4) (c) $y = \displaystyle\int e^{\sin x} \cos x \, dx$

(4) (d) $y = \displaystyle\int \frac{x}{\sqrt{x^2+2x+5}} \, dx$

(4) (e) $y = \displaystyle\int \frac{1}{x^2+7x+10} \, dx$

(4) (f) $y = \displaystyle\int \sin^3 x \cos x \, dx$

(4) (g) $y = \displaystyle\int \ln x \, dx$

(4) (h) $y = \displaystyle\int \frac{x+4}{x(x^2+1)} \, dx$

(4) (i) $y = \displaystyle\int \sec^3 x \, dx$

Answers

1. (a) $\dfrac{5}{2}x^2 - 6x - \dfrac{11}{2}$
   (b) $= -24$
2. $\dfrac{19}{3}$
3. $y = -e$
4. (a) $\dfrac{3x^2y + 3x^4y^3 - y}{x}$
   (b) $\dfrac{2}{\sqrt{-4x^2-4x}} + \dfrac{5}{5x\sqrt{25x^2-1}}$
   (c) $\dfrac{1}{2\sqrt{x}} \cot\sqrt{x} + 3x^2 \cos x - x^3 \sin x$
   (d) $3e^{\tan 3x} \cdot \sec^2 3x - 3\csc^2 x \cot^2 x$

(e) $\dfrac{\tan x}{3^x \ln x} - \dfrac{\log_7(\sec x)\ln 3}{3^x}$

5. $x_3 = 1.18$

6. $R_1 = 16\Omega; R_2 = 16\Omega$

7. $v = \displaystyle\int_0^4 \pi \left[(y+4)^2 - \frac{y^2}{2}\right]$

8. $\dfrac{125}{6}$

9. $\sqrt{\dfrac{2}{3}\cos^3 x + 2c}$

10. $\dfrac{\pi}{4(2n+1)} \cdot \sin[(2n+1)x]$ Let n start at 0.

11. $\dfrac{2}{5}\sin x - \dfrac{1}{5}\cos x + \dfrac{c}{e^{2x}}$

12. $0.022s$

13. (a) $\dfrac{\tan^{10} x}{10} + c$

(b) $\sin(1)$

(c) $e^{\sin x} + c$

(d) $\dfrac{1}{2}(x^2+2x+5) - \arctan\left(\dfrac{x+1}{2}\right) + c$

(e) $\dfrac{1}{3}\ln\left|\dfrac{x+2}{x+5}\right| + c$

(f) $\dfrac{\sin^4 x}{4} + c$

(g) $x\ln x - x + c$

(h) $\ln\dfrac{x^4}{(x^2+1)^2} + \arctan x + c$

(i) $\dfrac{1}{2}[\sec x \tan x + \ln|\sec x + \tan x|] + c$