

Extra Credit/Review Problems

Instructions

Your best 4 problems will be counted.

A full 30 points counts as one homework assignment.

No credit will be given for answers without justification.

Compute the definite integral (1 pt each).

1) $\int x\sqrt{x^2 + 1} dx$

Ans: $\frac{1}{3}(x^2 + 1)^{\frac{3}{2}} + C$

2) $\int \cos^2(t) \sin(t) dt$

Ans: $-\frac{1}{3} \cos^3(t) + C$

3) $\int \frac{y^2+1}{y^3+3y} dy$

4) $\int \frac{b - \cos(b) \sin(b)}{\sqrt{b^2 + \cos^2(b)}} db$

Simplify (2 pts each)

5) $e^{i\frac{\pi}{2}} + e^{-i\frac{\pi}{2}}$

Ans: 0

6) $\sqrt{2}e^{i\frac{\pi}{4}}$

Ans: $1 + i$

7) $e^{i\frac{3\pi}{4}}$

8) $e^{i\frac{\pi}{4}} - e^{-i\frac{\pi}{4}}$

Simplify (3 pts each)

9) $e^{1+i\pi}$

Ans: $-e$

10) $e^{2t+i\frac{\pi}{4}t}$

Ans: $e^{2t}(\cos(\pi t/4) + i \sin(t\pi/4))$

11) $e^{2+i\pi/2}$

12) $e^{-x+ix\pi/8}$

Find the general solution (4 points each)

13) $y'' + 7y' + 12y = 0$

Ans: $y(t) = c_1 e^{-4t} + c_2 e^{-3t}$

14) $y'' - 5y' + 4y = 0$

15) $\frac{d^2 y}{dt^2} + 2\frac{dy}{dt} + 10y = 0$

16) $\frac{d^2 y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$

Find the solution (5 points each)

17) $y'' + 6y' + 10y = 0$

Ans: $y(t) = C_1 e^{-3t} \cos(t) + C_2 e^{-3t} \sin(t)$

18) $x'' - 2x' + 2x = 0$

19) $\frac{d^2 s}{dt^2} - 8\frac{ds}{dt} + 20s = 0$

20) $y'' + 3y' + 7y = 0$

Work the problem (10 points each)

21) Find the length of the path

$$\begin{aligned}x &= \cos^2(t) + \sin^4(t) \\y &= \frac{4\sqrt{2}}{3} \sin^3(t)\end{aligned}$$

for $0 \leq t \leq \pi/4$.

22) A large spring of natural length 5m is mounted to the floor. Two blocks of equal mass are placed on the spring. The spring contracts by 1.5m after the first block is placed on the spring. When the second mass is placed on the spring, the work done to the spring is $\frac{9}{4}J$. Find the mass of either one of the blocks.