MATH 2400 HW0
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1.$I_a = \int x \ln x \, dx$

$$\begin{aligned}
&\int x \ln x \, dx \\
&= \frac{lnx}{2}x^2 - \int \frac{x^2}{2}\frac{1}{x} + C \\
&= \frac{lnx}{2}x^2 - \int \frac{x}{2} + C \\
&= \frac{lnx}{2}x^2 - \frac{x^2}{4} + C
\end{aligned}$$

2.$I_b = \int \frac{x}{x^2+3} \, dx$

$$\begin{aligned}
&\int \frac{x}{x^2+3} \, dx \\
&\text{Let } u = x^2+3, \text{ then } \ du = 2x \, dx \\
&= \frac{1}{2} \int \frac{1}{u} \, du + C \\
&= \frac{1}{2} \ln u + C \\
&= \frac{1}{2} \ln(x^2+3) + C
\end{aligned}$$

3.$I_c = \int_0^2 te^{-t} \, dt$

$$\begin{aligned}
&\int_0^2 te^{-t} \, dt \\
&= -te^{-t}\Big|_0^2 + \int_0^2 e^{-t} dt \\
&= -2e^{-2} - e^{-t}\Big|_0^2 \\
&= 1 - 3e^{-2}
\end{aligned}$$

4.$y^2 + 2y + t^3 + sin(t) - 3 = 0$

$$\begin{aligned}
y^2 + 2y + t^3 + sin(t) - 3 = 0& \\
y^2 + 2y &= 3 - sin(t) - t^3 \\
y^2 + 2y + 1 &= 4 - sin(t) - t^3 \\
(y+1)^2 &= 4 - sin(t) - t^3 \\
y &= \\
sqrt4 - sin(t) - t^3 - 1&
\end{aligned}$$

5.

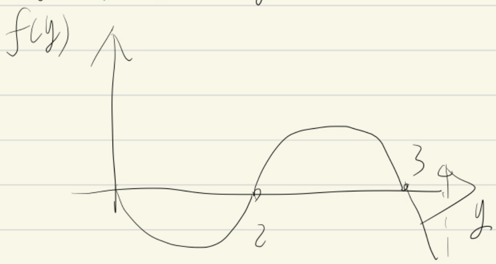
$f(y) = y(y-2)(3-y)$

roots : $0, 2, 3$

$y \in (0,2) : f(y) < 0$

$y \in (2,3) : f(y) > 0$

$y \in (3,4) : f(y) > 0$



$y' > 0$ for $2 < y < 3$