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5. Find $\int \frac{\cos x}{\sin x} dx = \int \frac{dy}{y} = \boxed{\ln|\sin x| + c}$

$\uparrow$

$u = \sin x$

$du = \cos x \, dx$

6. Let $f(x) = xe^{2x}$. Where is $f(x)$ increasing, decreasing, concave up, and concave down. Find the local maxima, local minima, and points of inflection of $y = f(x)$. Graph $y = f(x)$.
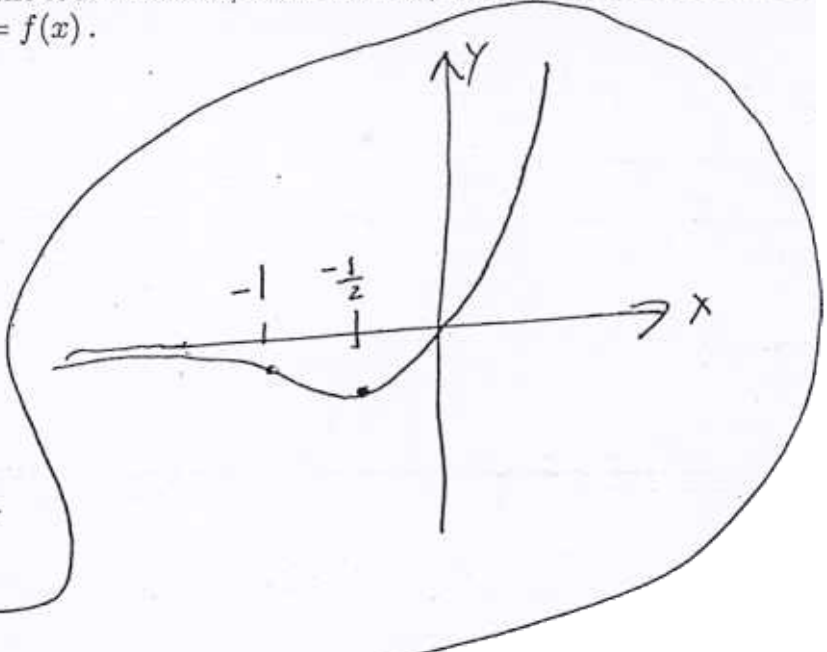
$f' = x2e^{2x} + e^{2x}$

$\quad = e^{2x}(2x+1)$

$f'' = 4xe^{2x} + 2e^{2x} + 2e^{2x}$

$\quad = 4e^{2x}(x+1)$

f' neg $\qquad f'$ pos

$\qquad -\frac{1}{2}$

f'' neg $\qquad f''$ pos

$\qquad -1$

f is inc for $-\frac{1}{2} < x$

f is dec for $x < -\frac{1}{2}$

f is c.u. for $-1 < x$

f is c.d. for $x < -1$

no local max

$(-\frac{1}{2}, f(-\frac{1}{2}))$ is a local min

$(-1, f(-1))$ is an inflection pt