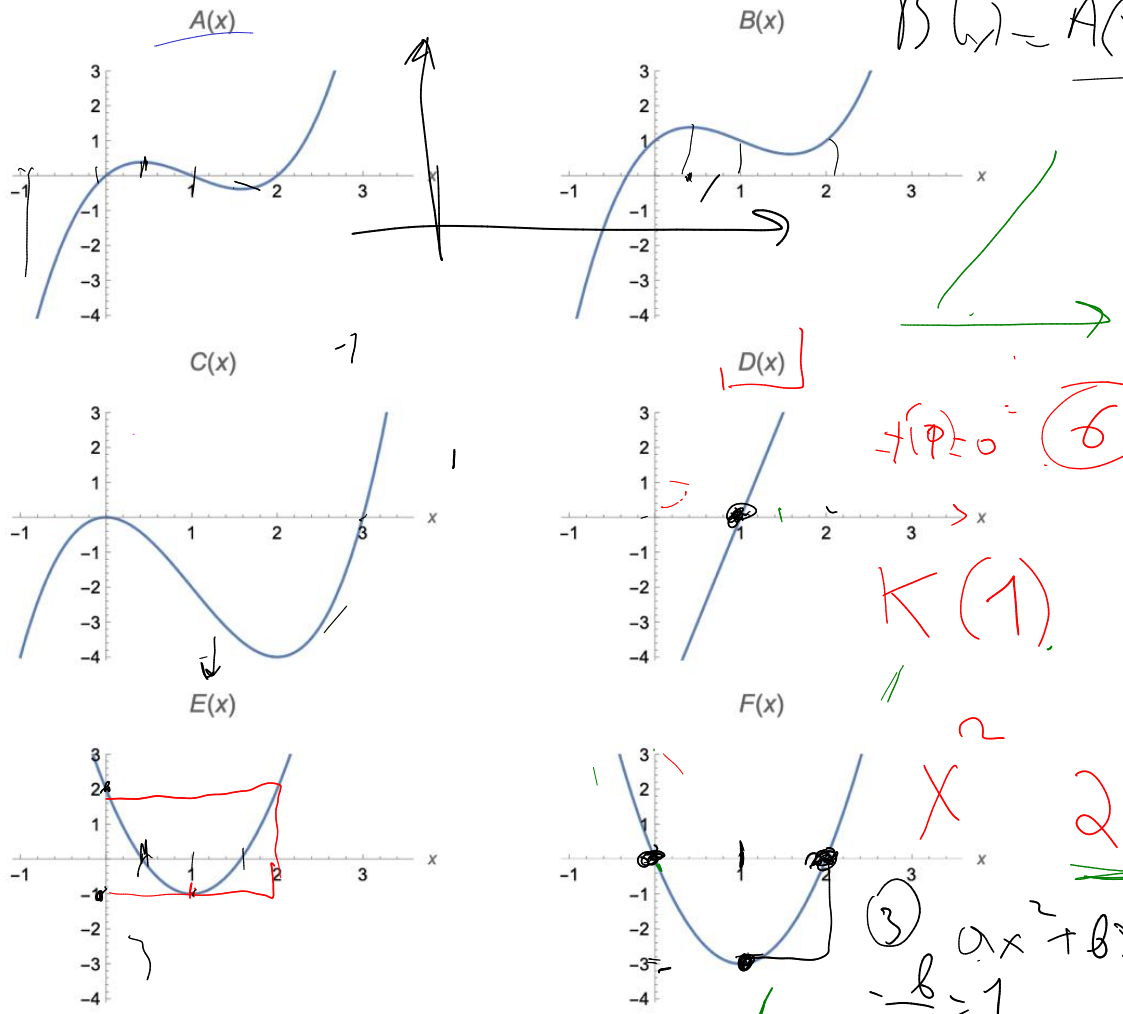
1 Graphs of Functions and Derivatives (12 points)

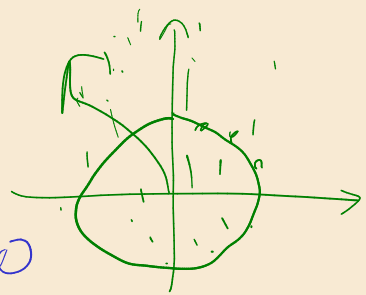
The graphs of six functions $A(x), B(x), C(x), D(x), E(x)$ and $F(x)$ are given below.



In the table at the end of the next page, mark which function of the six functions is the derivative of another function and briefly give reasons for your choice. *12 points*

$f(x,y) = 3x + 4y$

$x^2 + y^2 - 225 = 0 \quad g(x,y) = 0$



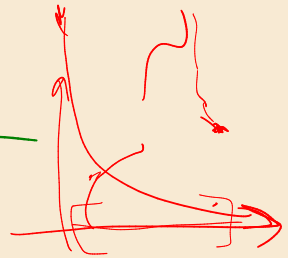
$\ell \quad \underbrace{3x + 4y - \lambda(x^2 + y^2 - 225)}$

$3 - 2\lambda x = 0 \qquad 2\lambda x = 3$

$4 - 2\lambda y = 0 \qquad x = \frac{3}{2\lambda}$

$x, y \qquad y = \frac{2}{\lambda}$

$x^2 = 4 \qquad \left(\frac{3}{2\lambda}\right)^2 + \left(\frac{2}{\lambda}\right)^2 = 225$



$x = 2 \qquad 3x + 4y \quad \frac{9}{4\lambda^2} + \frac{4}{\lambda^2} = 225 \quad [1, 2]$

$\sqrt{\frac{9}{8}} = \frac{\sqrt{9}}{\sqrt{8}}$

$\frac{3}{2} \cdot \frac{1}{6} \qquad (9, 12) \qquad (-9, -12)$

$9 + 16 = 4225\lambda^2$

$\boxed{\lambda^2 = \frac{25}{4 \cdot 225} \qquad \lambda = \frac{\cancel{5}}{2 \cdot 1\cancel{5}} = \pm\frac{1}{6}}$

$x = \frac{1}{6}$.

$\Delta f^* \approx \lambda \cdot \Delta x = \frac{1}{6}(224 - 224$

$\max_{x \in} f$

$= -\frac{1}{6}$

$75 - \frac{1}{6} \approx 74.83$

$\lambda (4.2 - 4)$ kt

$y e^x$

$2x + y = 4$

$x \geq 0$

$y \geq 0$

$L(x) = y e^x - \lambda(2x + y - 4)$

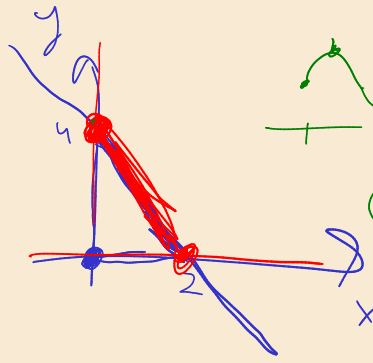
$y e^x - 2\lambda = 0 \quad | \cdot 3x + 4y = 4.2$

$e^x - \lambda = 0 \rightarrow e^x = \lambda$ pf=

$x = \ln \lambda$

(0, 4)

(2, 0)



$y = 2$

$2x + y = 4 \Rightarrow x = 1$

e^x

$y e^x$

(1, 2)

(0, 4)

(2, 0)

$2x + y = 4$

$y = 4 - 2x$