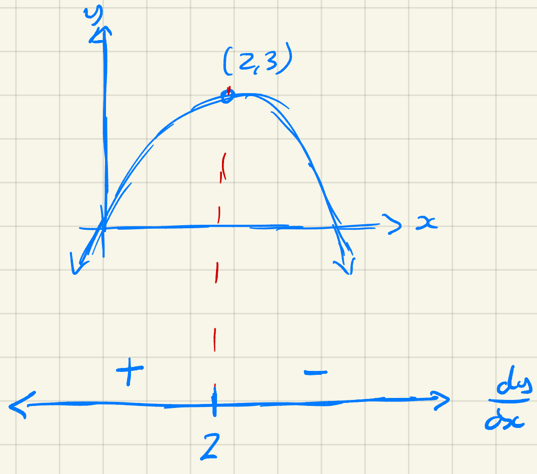
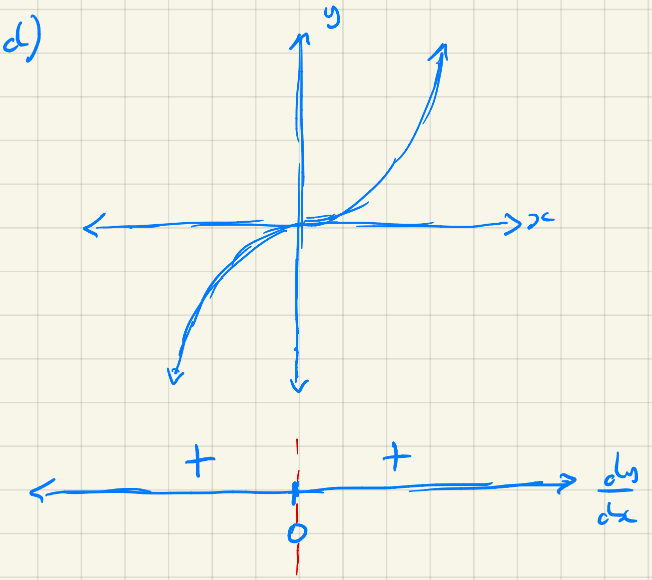
13c

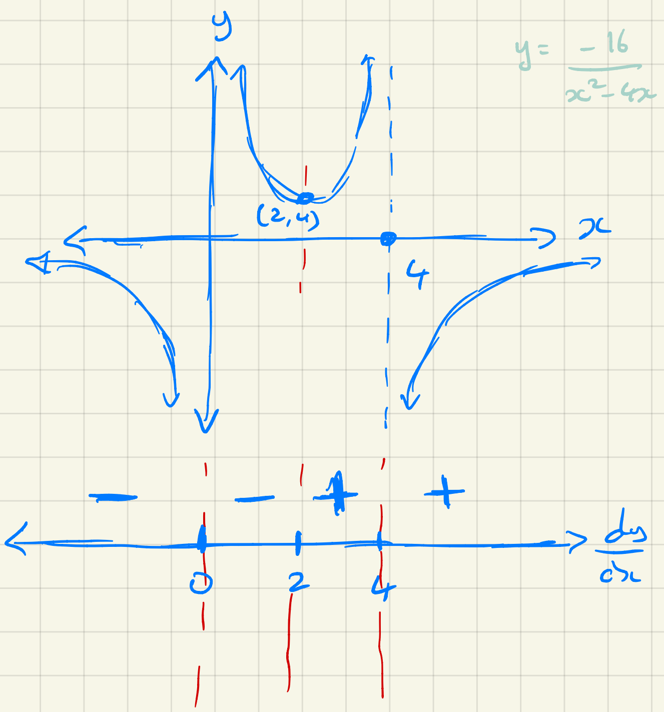
1. c)



d)



f)



4.

e. $f(x) = \frac{2}{\sqrt{x}} = 2x^{-\frac{1}{2}}$

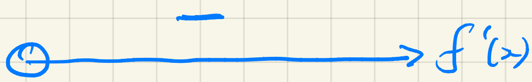
$f'(x) = 2 \quad -\frac{1}{2}x^{-\frac{3}{2}}$

$= -\frac{1}{x^{3/2}} = -\frac{1}{x\sqrt{x}}$

Domain: $\{x \mid x > 0\}$

if $x < 0$ $\sqrt{x}$ undefined
and $\frac{1}{0}$ is undefined.

Test: $f'(1) = -1$



Function Decreasing on $(0, \infty)$

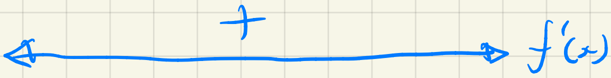
5. $f(x) = x^3 - 3x^2 + 5x + 2$

$f'(x) = 3x^2 - 6x + 5$

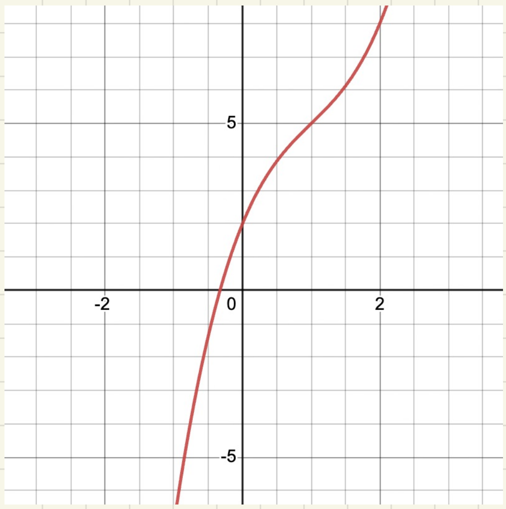
$f'(x) = 0 \implies$ no solution

$\Delta = (-6)^2 - 4 \times 3 \times 5$
$= 36 - 60 = -24$

$f'(x) > 0$ for all x



Function always increasing



9. $f(x) = \frac{-x^2+4x-7}{x-1}$

$$\left(\frac{u}{v}\right)' = \frac{u'v-uv'}{v^2}$$

$u = -x^2+4x-7$, $u' = -2x+4$

$v = x-1$, $v' = 1$

$$f'(x) = \frac{(-2x+4)(x-1)-(-x^2+4x-7)1}{(x-1)^2}$$

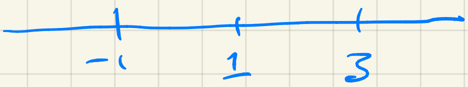
$$= \frac{-2x^2+6x-4+x^2-4x+7}{(x-1)^2}$$

$$= \frac{-x^2+2x+3}{(x-1)^2} = -\frac{(x^2-2x-3)}{(x-1)^2}$$

$$= -\frac{(x-3)(x+1)}{(x-1)^2}$$

$f'(x) = 0$ when $x = 3$, $x = -1$

also $f(x)$ undefined when $x-1=0$, $x = 1$



Test $f'(-2) = -\frac{(-5)(-1)}{(-2-1)^2}$

$f'(-2) < 0$

Test $f'(0) = -\frac{(-3)(+1)}{(-1)^2}$

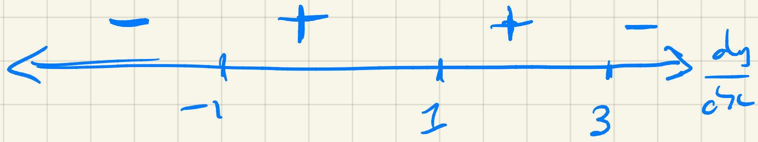
$f'(0) > 0$

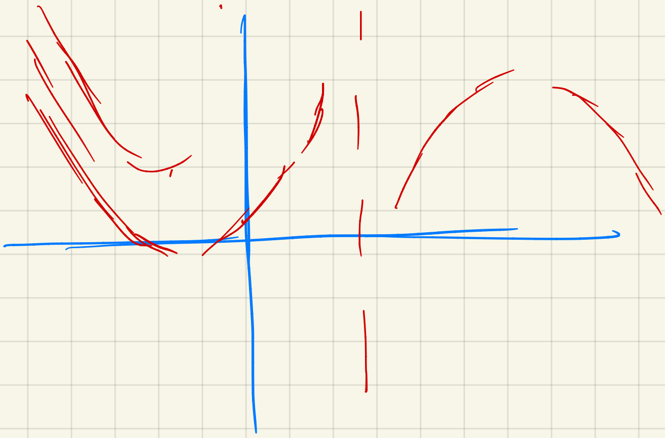
Test $f'(2) = -\frac{(-1)(3)}{(2-1)^2}$

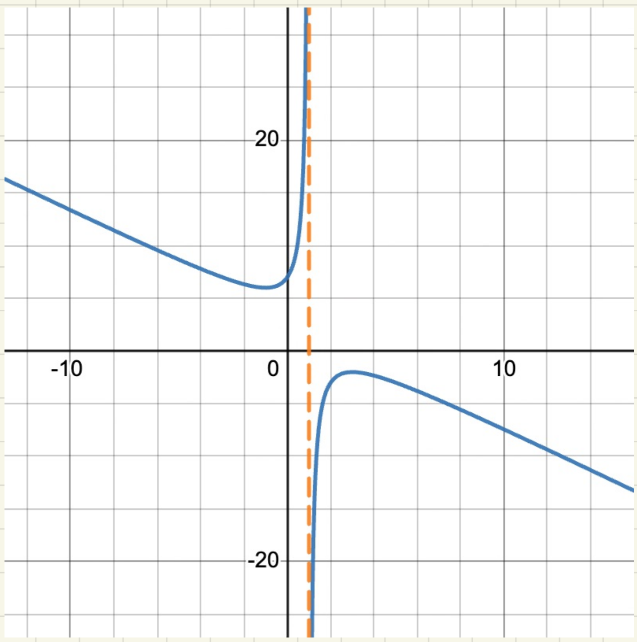
$f'(2) > 0$

Test $f'(4) = -\frac{(1)(5)}{(4-1)^2}$

$f'(4) < 0$







11. c)

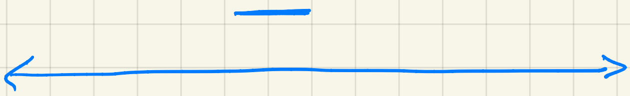
$f(x) = 3 + e^{-x}$

$f'(x) = -e^{-x}$

$f'(x) \neq 0$

Doman $\{x \mid x \in \mathbb{R}\}$

$f'(0) = -e^{0} = -1$



Decreasing everywhere

d) $f(x) = xe^{x}$

$(uv)' = uv' + u'v$

$f'(x) = xe^{x} + 1e^{x}$

$= e^{x}(x+1)$

$e^{x}(x+1) = 0$

$e^{x} \neq 0 \quad x+1=0$

$x = -1$

Test $f'(0) = e^{0}(0+1) = 1$

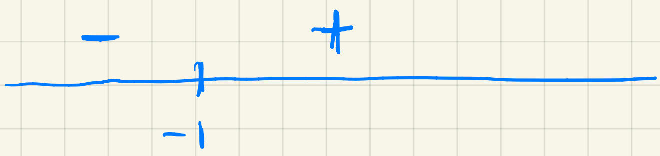
$f'(0) > 0$

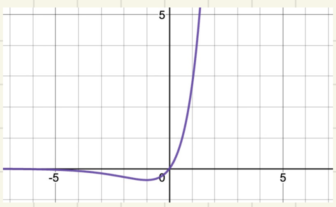
Test $f'(-2)$

$f'(-2) = e^{-2}(-2+1)$

$= -e^{-2}$

$f'(-2) < 0$





f) $f(x) = x^{3} \ln x$

Domain $\{x \mid x > 0\}$

$(uv)' = uv' + u'v$

$f'(x) = x^{3} \cdot \frac{1}{x} + 3x^{2} \ln(x)$

$= x^{2} + 3x^{2} \ln x$

$= x^{2}(1 + 3\ln x)$

$f'(x) = 0$

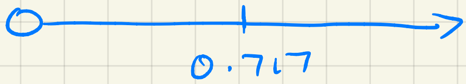
$\Rightarrow \quad x^{2} = 0, \quad x = 0$ (outside domain)

$1 + 3\ln x = 0$

$3\ln x = -1$

$\ln x = -\frac{1}{3}$

$x = e^{-\frac{1}{3}} \quad x \simeq 0.717$



Test $x = 0.5$

$f'(0.5) = (0.5)^{2}(1 + 3\ln(0.5))$

$= (0.5)^{2}(-1.079)$

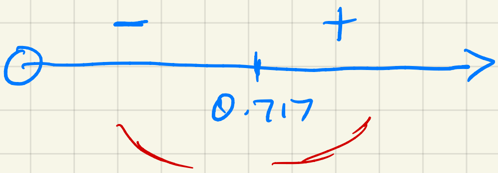
$f'(0.5) < 0$

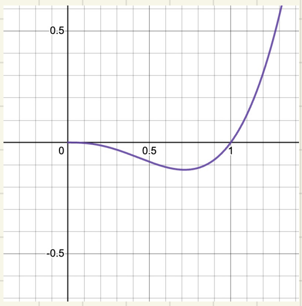
Test $x = 1$

$f'(1) = 1^{2}(1 + 3\ln 1)$

$= 1^{2}(1)$

$f'(1) > 0$





k) $f(x) = \ln(x^2+4)$

$x^2+4 > 0 \quad \forall\, x \in \mathbb{R}$

$\Rightarrow$ Domain $\{x \mid x \in \mathbb{R}\}$

$$(g(u))' = g'(u) \cdot u'$$

$$f'(x) = \frac{1}{x^2+4} \cdot 2x$$

$$= \frac{2x}{x^2+4}$$

$f'(x) = 0 \quad \Rightarrow \quad x = 0$

Test $x=-1$ $\quad f'(-1) = \frac{-2}{5} < 0$

Test $x=1$ $\quad f'(1) = \frac{2}{5} > 0$