1.) $f(x) = x + \frac{1}{x}$ A. $(-\infty, -1) \cup (1, \infty)$

$$f'(x) = 1 + \left(\frac{x(0) - 1(1)}{x^2}\right)$$

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

$$0 = 1 - \frac{1}{x^2}$$

$$\frac{1}{x^2} = 1$$

$$1 = x^2$$

$$x = \pm 1$$

$\rightarrow x \neq 0$
DISCONTINUITY

$f'(x)$	+	−	−	+
x	−1	0	1	

INC: $(-\infty, -1) \cup (1, \infty)$

2. What are all values of x for which the function f defined by $f(x)=(x^2-3)e^{-x}$ is increasing?

$f'(x)=(x^2-3)(-e^{-x})+e^{-x}(2x)$

(A) There are no such values of x.

(B) $x<-1$ and $x>3$

(C) $-3<x<1$

(D) $-1<x<3$

(E) All values of x

$-e^{-x}(x^2-3-2x)=0$

$-e^{-x}(x^2-2x-3)=0$

$(x-3)(x+1)=0$

$f'(x)$ − | + | −

X −1 3

$|4-x^2|$

3) $f'(x) = \frac{|4-x^2|}{x-2} = 0$

$x = 2, -2$

DECR: $(-\infty, 2)$

A

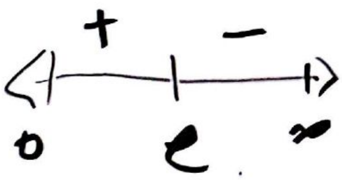
4) $f(x) = \frac{\ln(x)}{x}$

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

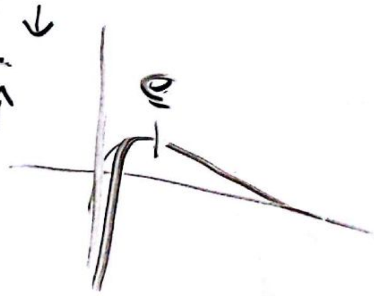
$$f'(x) = \frac{1 - \ln(x)}{x^2} = 0$$

$\ln(x) = 1$

$x = e$



$$\frac{1 - \ln(x)\ \downarrow}{x^2\ \uparrow}$$



e is correct

5

$f(x) = (x-2)(x-3)^2$

$f(x) = x^3 - 8x^2 + 21x - 18$

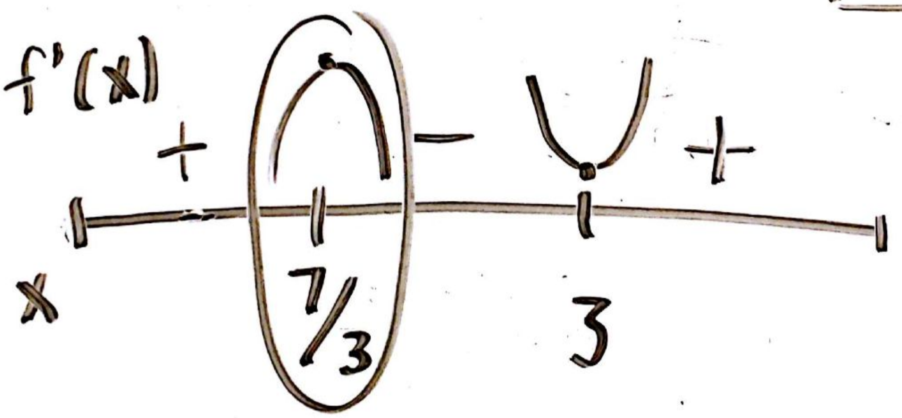
$f'(x) = 3x^2 - 16x + 21$ D:

$0 = 3x^2 - 16x + 21$

$(3x-7)(x-3) = 0$

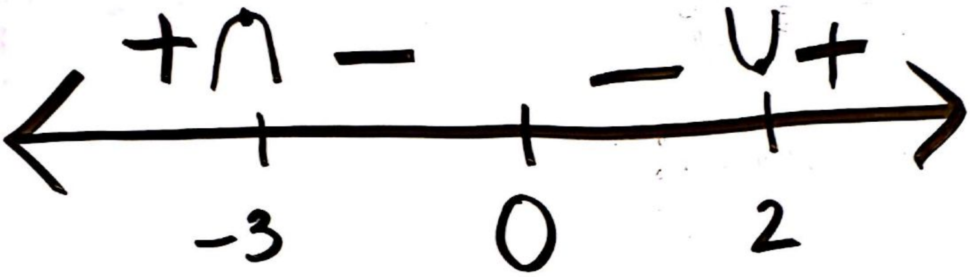
$x = 7/3$ & 3

$\boxed{\text{relative max @ } x = 7/3}$



6 $x^4(x-2)(x+3)$

$x = 0, 2, -3$



One relative max at $x=-3$

B

7) $f(x) = x^3 - 3x^2 + 12$ $[-2, 4]$

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

$3x(x-2)$

$x=0$ $x=2$

$f'(x)$	+		−		+
x		0		2	

X	Y
−2	−8
0	12
2	8
4	28

abs max: (4, 28)

A

8) $f(x)=(x)(\ln x)$

$f'(x)=(x)\left(\frac{1}{x}\right)+(\ln x)(1) = 1+\ln x$

$f'(x)=\ln x+1$

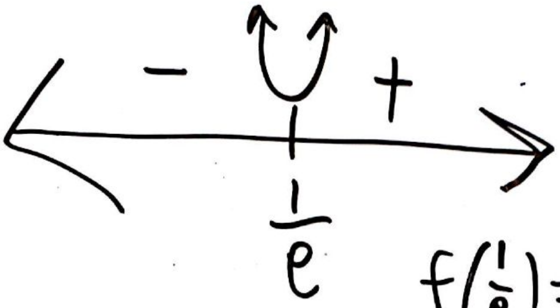
$\ln x+\cancel{1}=0$

$\quad\ \ -\cancel{1}\quad -1$

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

$x=e^{-1}$

$\frac{1}{e}=x$



$f\left(\frac{1}{e}\right)=\frac{1}{e}\left(\ln\frac{1}{e}\right)=\frac{-1}{e}$ min value

$\boxed{C}$

9. $f'(x) = 2x + e^{-2x} \cdot -2$

$f'(0) = 2(0) + e^{-2(0)} \cdot -2$

$0 + 1 \cdot -2$

$f'(0) = -2$

f is decreasing

10. If g is a differentiable function such that $g(x) < 0$ for all real numbers x and if $f'(x) = (x^2 - 4)g(x)$, which of the following is true?

(A) f has a relative maximum at x=-2 and a relative minimum at x=2.

(B) f has a relative minimum at x=-2 and a relative maximum at x=2.

(C) f has relative minima at x=-2 and at x=2.

(D) f has relative maxima at x=-2 and at x=2.

(E) It cannot be determined if f has any relative extrema.

$x^2 - 4 = 0$ $\qquad$ $g(x) = 0$

$x = \pm 2$

$f'(x)$ $\qquad - \quad | \quad + \quad | \quad -$

x $\qquad\qquad -2 \qquad 2$

$f'(0) = (-)(-)$

$f'(-3) = (+)(-)$

$f'(3) = (+)(-)$

Scott R