

(show all your work and circle one letter to get a full mark or you will get zero)

1) The function

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

is

- (a) Decreasing on  $(-\infty, +\infty)$   
 (b) Increasing on  $(0,1)$  and on  $(1,2)$   
 (c) Increasing on  $(0,1)$  and decreasing on  $(1,2)$   
 (d) Increasing on  $(1,2)$  and decreasing on  $(0,1)$   
 (e) Decreasing on  $(0,1)$  and on  $(1,2)$   
 (f) none of the above

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

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

Criticals  $x=0, x=3/2, x=2$ Domain:  $1-(x-1)^2 > 0$  and  $x \neq 0$ 

$$\Rightarrow x(2x-3) < 0 \Rightarrow \frac{0}{\infty} \rightarrow 2$$

Domain  $[0, 2]$ 

	$x=0$	$x=3/2$	$x=2$
$f'$	+	-	+

2)

The function  $f(x) = x^4 - 4x^2$  has

- (a) one local max and one local min  
 (b) one local max and no local min  
 (c) one local min and no local max  
 (d) two local max and one local min  
 (e) two local min and one local max  
 (f) none of the above

$$f'(x) = 4x^3 - 8x = 4x(x^2 - 2)$$

$$= 4x(x - \sqrt{2})(x + \sqrt{2})$$

	$-\sqrt{2}$	$0$	$+\sqrt{2}$
$4x$	-	+	+
$x - \sqrt{2}$	-	-	+
$x + \sqrt{2}$	-	+	+
$f'$	(-)	(+)	(-)

3) The function

$$f(x) = \ln(x^2 - 3x + 2)$$

has

- (a) one local max and one local min  
 (b) one local max and no local min  
 (c) one local max and two local min  
 (d) two local max and one local min  
 (e) one local min and no local max  
 (f) none of the above

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

Domain of  $f(x)$ :  $x^2 - 3x + 2 > 0$   
 $(x-2)(x-1) > 0$ 

	$x=1$	$x=2$
$f'$	(+)	(-)

Domain of  $f(x)$ :  $(-\infty, 1) \cup (2, +\infty)$ 
 $f'(x) = 0 \Rightarrow x = 3/2$  } all these not  
 $f'(x) \text{ DNE} \Rightarrow x = 1, x = 2$  } domain of  $f$ 
 $f(x)$  has no criticals $\Rightarrow f(x)$  has no loc. max no loc. min