2,3,4.

136.151: Test #3
Solutions

Name:______________________ **Student Number:** _______

1. Differentiate (with respect to x):

(a) $\ln(\sqrt{\tan x})$
(b) $e^{\cos 2x}$

Solutions. **(a)** $\left(\ln(\sqrt{\tan x})\right)' = \dfrac{1}{\sqrt{\tan x}}\dfrac{1}{2\sqrt{\tan x}}\dfrac{1}{\cos^2 x}$

(b) $\left(e^{\cos 2x}\right)' = 2(-\sin 2x)e^{\cos 2x}$

2. Use derivatives to show that the function $\dfrac{2}{x}$ decreases everywhere over its domain.

Solution. $\left(\dfrac{2}{x}\right)' = -\dfrac{2}{x^2}$ and this is apparently negative for all values of x in the domain of the starting function. Consequently the function $\dfrac{2}{x}$ always decreases.

3. **(a)** Find all critical points of the function $f(x) = x^3 - 3x$.
(b) Classify these points (as yielding a local minimum, a local maximum or neither). Justify your answers (say, by using a table as in class).

Solution. **(a)** $f'(x) = 3x^2 - 3$ and solving $f'(x) = 0$ yields two critical points $x = 1$ and $x = -1$.

(b) The following table does it.

	$(-\infty,-1)$	$(-1,1)$	$(1,\infty)$
x	-2	0	2
$f'(x)$	+	-	+
$f(x)$	$\nearrow$	$\searrow$	$\nearrow$

So, we have a local maximum at x=-1 and a local minimum at x=1.