MAC 2313 Calculus 3 **Test 2** 20 Oct 1998

Show **ALL** work for credit; be neat; and use only **ONE** side of each page of paper. Do **NOT** write on this page. Calculators can be used for graphing and calculating only.

1. Find ∇f and $D_{\mathbf{u}}f$ if $\mathbf{u} = \langle -1/\sqrt{5}, 2/\sqrt{5} \rangle$ and $f(x,y) = x \sin y$

2. If $u = xy + yz + zx, x = st, y = e^{st}$, and $z = t^2$, use the chain route to find

$$\frac{\partial u}{\partial s} \quad and \quad \frac{\partial u}{\partial t}.$$

3. Find the equation of the tangent plane to the surface $x^2 - 2y^2 - 3z^2 + xyz = 4$ at the point $(3, -2, -1)$.

4. Show the limit below does not exist.

$$\lim_{(x,y)\to(0,0)} \frac{x^2}{x^2 + y^2}$$

5. The table below lists values for a particular function $f(x,y)$. For each **CRITICAL** point in the table determine if it is a local minimum, a local maximum or a saddle point.

(x,y)	$f(x,y)$	$f_x(x,y)$	$f_y(x,y)$	$f_{xx}(x,y)$	$f_{yy}(x,y)$	$f_{xy}(x,y)$
$(0,0)$	25	0	0	2	4	1
$(1,0)$	12	0	0	4	0	2
$(1,1)$	11	0	2	2	4	8
$(2,1)$	3	0	0	-2	-3	2
$(2,2)$	13	3	0	-9	3	-4
$(-1,-2)$	1	0	0	0	4	-7

6. Set up but do **NOT** evaluate the interated integral (or sum of interated integrals) which will give the volume under the paraboloid $z = x^2 + y^2$ and above the region bounded by $y = x^2$ and $x = y^2$.

7. Sketch the region of integration and change the order of integration of

$$\int_0^1 \int_{\sqrt{y}}^1 f(x,y)dxdy$$

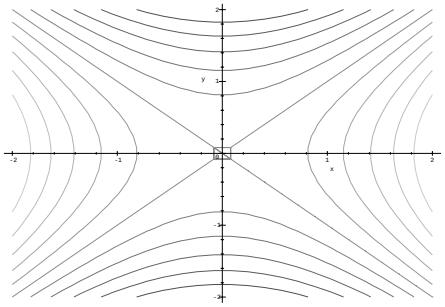
8. Convert to polar coordinates and integrate.

$$\int_0^1 \int_0^{\sqrt{1-x^2}} e^{x^2+y^2} dydx$$

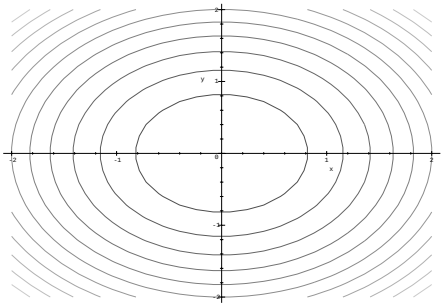
9. Find the point on the plane $2x - y + z = 1$ that is closest to the point $(-4, 1, 3)$.

10. On the other side of the page are Maple contour graphs of the functions (in some order) of $x + y$,$x - y$,xy,$x - y^2$,$x^2 - y$,$x^2 + y^2$,$x^2 - y^2$ and $x^3 - 3xy^2$. Identify which is which. The plots are over $[-2, 2] \times [-2, 2]$. But note that the unit length in the y-direction is smaller than the unit length in the x-direction. (That is, the aspect ratio is not one.)

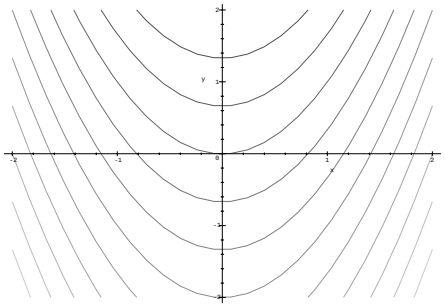
contour 1



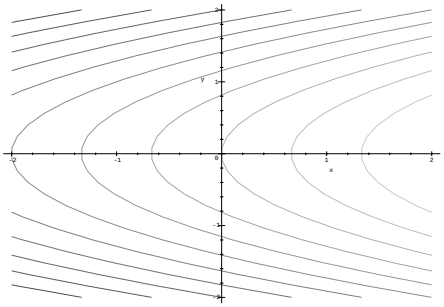
contour 2



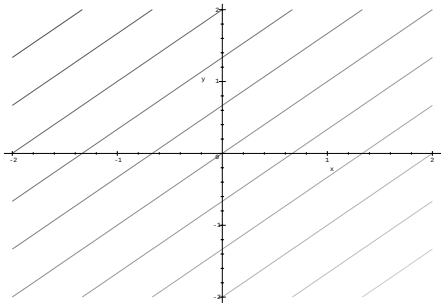
contour 3



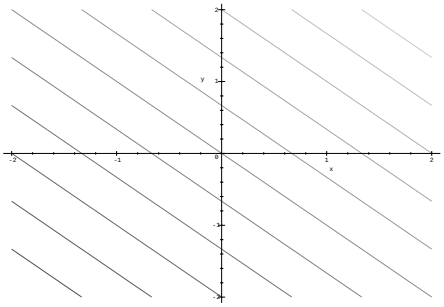
contour 4



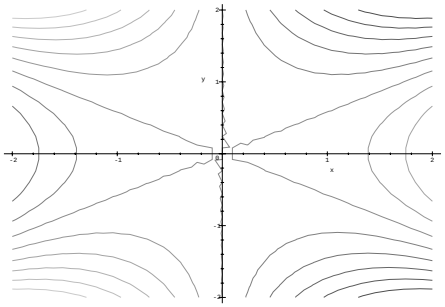
contour 5



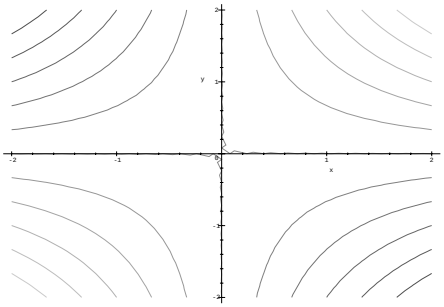
contour 6



contour 7



contour 8



Maple Contour Plots