Math 114 (Powers) 1½ Hour Test. Thursday March 5, 2009

Name(print)__________________________________ Penn I.D. ______________________

Signature______________________________________

1. Find the distance between the straight lines, $\vec{r_1}(t) = \langle 1,1+t,2+2t \rangle$ and $\vec{r_2}(t) = \langle t,0,2t \rangle$ where t runs from $-\infty$ to $+\infty$.

   A. 1/3 B. $1/\sqrt{3}$ C. 1/2 D. 2/3 ## E. $2/\sqrt{3}$ F. 2 G. $\sqrt{2}$ H. $\sqrt{5}$

2. Suppose y(x) satisfies the intergral equation $y(x) = 2 + \int_0^x 2y(t)\,dt$. Then what is y(1)? (Hint. Differentiate) y(1) =

   A. $2e^{1/2}$ B. 2/e C. 2 D. $2e^2$ ## E. 2e F. $2\sqrt{2}$ G. 4 H. 8/3

3. Find the plane equidistant from the points $\langle 1,2,3 \rangle$ and $\langle 2,1,0 \rangle$. Where does this plane intersect the z-axis? z-intersect =

   A. -1 B. -½ C. 0 D. ½ E. 1 F. 1½ ## G. 2 H. 2½

4. As θ goes from $-\pi$ to π the point $(a\cdot\cos(\theta), b\cdot\sin(\theta))$ goes around the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. Find the curvature of the ellipse at x = a, y = 0 or when $\theta = 0$. Curvature =

   A. $\frac{a}{a^2+b^2}$ B. $\frac{2a}{a^2+b^2}$ C. $\frac{b}{a^2+b^2}$ D. $\frac{2b}{a^2+b^2}$ E. $\frac{b}{a^2}$ F. ## $\frac{a}{b^2}$ G. $\frac{1}{a}$ H. $\frac{1}{b}$

5. Find the equation for the plane tangent to the surface $z = 2x^2 + y^2$ at (x,y,z) = (1,-2,6) and determine where the plane intersects the z-azis. The plane intersects the z-axis at z =

   A. 2 B. ½ C. 0 D. -½ E. -4 F. -6 ## G. -7½ H. - 11

6. Find the equation for the plane tangent to the surface $x^2 - xy + y^2 + z^2 = 4$ at (x,y,z) = (1,-2,1). Find where the plane intersects the z-axis. The z-intercept is = A. 8 ## B. 4 C. 2 D. 0 F. -1 G. -3 H. -5

7. Suppose $r = \sqrt{x^2 + y^2 + z^2}$ and x(t),y(t),z(t) are functions of time t. We have r(t) is a function of t. Compute $\frac{dr}{dt}$ at time t = 0 given that x = 1, y = 2, z = 2 and $\frac{dx}{dt} = -2$, $\frac{dy}{dt} = 1$, $\frac{dz}{dt} = 1$. Then $\frac{dr}{dt}$ =

A. 0 B. 2/3 C. 1/3 D. -2## E. -2/3 F. 4/9 G. 3/2 H. -1

8. If $f(x,y,z) = r = r = \sqrt{x^2 + y^2 + z^2}$ and $\vec{u} = \langle 1/3, 2/3, -1/3 \rangle$ then the direction derivative $(D_{\vec{u}}f)(1,2,2)$ =

A. 0 B. 2/3 C. 1/3##D. -2 E. -2/3 F. 4/9 G. 3/2 H. -1

9. Find the maximum value of f(x,y) = x+y inside the region $x^2 + 4y^2 \le 5$.

A. 2½ ## B. $\sqrt{5}$ C. $\sqrt{3}$ D. 4 E. $\sqrt{6}$ F. ½$\sqrt{3}$ G. 4½ H. 1½

10. Suppose f is a function of x and y and $\frac{\partial f}{\partial x} = xy$. Which of the following could be $\frac{\partial f}{\partial y}$.

A. $x^3/6$ B. ½x^2## C. ½xy D. $y^2/3$ E. $x^3/3$ F. $2x^2y$ G. $2xy^2$ H. y^3

11. Suppose $f(x,y) = 2x^3 - 3x^2 - y^2 + 4y$. Find the critical points and determine their type.

A. {rel min at x=0,y=2; rel min at x=1,y=2}
B. {rel min at x=0,y=2; saddle at x=1,y=2}
C. {rel min at x=0,y=2; rel max at x=1,y=2}
D. {saddle at x=0,y=2; rel min at x=1,y=2}
E. {saddle at x=0,y=2; saddle at x=1,y=2}
F. {saddle at x=0,y=2; rel max at x=1,y=2}
G. {rel max at x=0,y=2; rel min at x=1,y=2}
H.## {rel max at x=0,y=2; saddle at x=1,y=2}

12. Suppose $f(x,y) = x^3 + 3xy + y^3$. Find the critical points and determine their types.

A. {rel min at x=0,y=0; rel min at x=-1,y=-1}
B. {rel min at x=0,y=0; saddle at x=-1,y=-1}
C. {rel min at x=0,y=0; rel max at x=-1,y=-1}
D. {rel max at x=0,y=0; rel min at x=-1,y=-1}
E. {rel max at x=0,y=0; saddle at x=-1,y=-1}
F.## {saddle at x=0,y=0; rel max at x=-1,y=-1}
F. {saddle at x=0,y=0; rel min at x=-1,y=-1}
G. {saddle at x=0,y=0; saddle at x=-1,y=-1}

13. Material for a box cost 2 cents per square foot for the top of the box and 1 cents per square foot for the bottom and sides. Find the largest volume that can be enclosed in a box costing 36 cents. Largest volume is cubic feet =

A. 3 B. 4$\sqrt{2}$ C. 6 D. 5$\sqrt{2}$ E. 8 F. 6$\sqrt{2}$ G. 12## H. 7$\sqrt{2}$