| The Hashemite University | Final Exam | January 13, 2013 |
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| Department of Mathematics | Calculus (3) | Time: Two Hours. |

اسم الطالب: الرقم الجامعي: رقم التسلسل:

مدرس المادة: وقت المحاضرة:

| | a | b | c | d |
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**Question One (50 points):** Choose **the best correct answer** and fill it in the above table.

1. $\int_{-3}^{3}\int_{-\sqrt{9-x^2}}^{\sqrt{9-x^2}}\int_{-\sqrt{25-x^2-y^2}}^{\sqrt{25-x^2-y^2}}\frac{1}{\sqrt{x^2+y^2}}dzdydx =$

(a) (b) (c) (d)

2. $\int_{0}^{2}\int_{\frac{y}{2}}^{1}\cos(x^2)\,dxdy =$

(a) (b) (c) (d)

3. $\int_{-1}^{1}\int_{2}^{4}e^{x+y}\,dxdy =$

(a) (b) (c) (d)

4. Let $R$ be the region enclosed by the curves $y = x$ and $y = x^2$. Then

$$\iint_R x(x+1)dA =$$

(a) (b) (c) (d)

5. Let $G$ be the solid in the first octant inside the sphere $x^2 + y^2 + z^2 = 9$. Then

$$\iiint_G \frac{e^{\sqrt{x^2+y^2+z^2}}}{x^2+y^2+z^2}dV =$$

(a) (b) (c) (d)

6. Let $G$ be the solid in the first octant cut from the cylinder $y^2 + z^2 = 1$ by the planes $y = x$ and the $yz$-plane. Then

$$\iiint_G \frac{1}{\sqrt{x^2+y^2}}dV =$$

(a) (b) (c) (d)

❖ If the closed circular region $x^2 + y^2 \leq 5$ is the domain of the function $f(x,y) = x^2 + 2y^2 - 2x + 3$. Based on this information, answer questions (7), (8) and (9):

7. The number of critical points of $f$ is

(a) (b) (c) (d)

8. The absolute maximum of $f$ is

(a) (b) (c) (d)

9. The absolute minimum of $f$ is

(a) (b) (c) (d)

❖ If $(1,2)$ is a critical point of the function $f(x,y) = x^3 + y^3 - ax - by + 20$. Based on this information, answer questions (10) and (11):

10. The value of $a + 2b =$

(a) (b) (c) (d)

11. At the point $(1,2)$ the function $f$ has

(a) a relative maximum (b) a relative minimum

(c) a saddle point (d) non of the previous

12. If the parametric equations of the line normal to the surface $z = ax^2y$ at the point $(2,1,4)$ are $x = 2 + 4t,\ y = 1 + bt,\ z = 4 - t$, then $a + 2b =$

(a) (b) (c) (d)

13. If the tangent line to the surface $ax^2 + 4y^2 + z^2 = 18$ at the point $(1,2,1)$ is $x + by + z = 18$, then $a + 2b =$

(a) (b) (c) (d)

14. The directional derivative of the function $f(x,y) = 4x^3y^2$ at the point $(2,1)$ in the direction of $\vec{a} = 4i - 3j$ is

(a) (b) (c) (d)

15. The maximum value of the directional derivative of the function $f(x,y) = 4x^2e^y$ at the point $(-2,0)$ is

(a) (b) (c) (d)

16. If $u = rs^2\ln(t),\ r = x^2, s = 4y + 1, t = xe^{3y}$. Then $\left.\frac{\partial u}{\partial y}\right|_{x=1,y=0} =$

(a) (b) (c) (d)

17. If $f(x,y) = x^3y^5 - 2x^2y + x$, then $f_{xyy}(1,-1) + 2f_{xyy}(-1,1) =$

(a) (b) (c) (d)

18. If $C$ be the curve with parametric equations $x = t^2 + t,\ y = t, t \geq 0$, then $\lim\limits_{\substack{(x,y)\to(0,0)\\ \text{along } C}} x^y =$

(a) (b) (c) (d)

19. $\lim\limits_{(x,y,z)\to(0,0,0)} \frac{2e^{\sqrt{x^2+y^2+z^2}}-2}{\sqrt{x^2+y^2+z^2}} =$

(a) (b) (c) (d)

20. If $\kappa(t)$ is the curvature of the curve $x = t^2 + 2t,\ y = \cos(t),\ z = 0$, then $\kappa(0) =$

(a) (b) (c) (d)

21. If $s$ is the arc length of the circular helix $\vec{r} = 2\cos(t)\, i + 2\sin(t)\, j + tk$ that has the reference point $(1,0,0)$ and the same orientation as that given for the helix, then $s =$

(a) (b) (c) (d)

22. If $D$ is the distance between the line $x = 1 + 3t,\ y = -4 + 2t,\ z = -3$ and the plane $2x - 3y + 6z = -1$, then $D =$

(a) (b) (c) (d)

23. The equation of the plane through the point $(1,1,1)$ and parallel to the plane $x + y - z = 2$ is

(a) (b) (c) (d)

24. If $A$ is the area of the parallelogram that has $\vec{u} = i - j$ and $\vec{v} = 3j + k$ as adjacent sides, then $A =$

(a) (b) (c) (d)

25. If $(3, \frac{\pi}{3}, 4)$ is a point given in cylindrical coordinates, then the spherical coordinates of this point are

(a) (b) (c) (d)

*End of Exam*

*Good Luck*