King Fahd University of Petroleum and Minerals

Department of Mathematics and Statistics

Spring Semester (Term 162)

Final Exam

MATH 132

Dr. Taleb Alkurdi

Name____ ID______________________________ Serial Number __________

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MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) $\lim\limits_{x \to 1} \dfrac{2x^2 + x - 3}{x^2 + 4x - 5} =$ 1) ________

A) 0 B) $\frac{2}{5}$ C) $\frac{5}{6}$ D) $\frac{1}{4}$ E) $\frac{3}{5}$

2) If $f(x) = \begin{cases} x, \text{ if } x \geq 2 \\ 2 - x, \text{ if } x < 2 \end{cases}$, then $\lim\limits_{x \to 2} f(x) =$ 2) ________

A) 0
B) 1
C) 2
D) ∞
E) does not exist

3) Let $f(x) = \dfrac{x^2 - 9}{x^2 + 2x + 1}$. The only value(s) of x for which f is discontinuous is (are) 3) ________

A) -1.
B) 1, -3 and 3.
C) -1, 1, -3, and 3.
D) -1 and 1.
E) -3 and 3.

4) By direct use of the definition of a derivative, the derivative of $f(x) = \dfrac{1}{x}$ is 4) ________

A) $\lim\limits_{h \to 0} \dfrac{1}{x + h}$.

B) $\lim\limits_{h \to 0} \dfrac{\frac{1}{x + h} - \frac{1}{x}}{h}$.

C) $\lim\limits_{h \to 0} \left[\dfrac{1}{x + h} + \dfrac{1}{x}\right]$.

D) $\lim\limits_{h \to 0} \dfrac{1}{h}$.

E) $\dfrac{1}{x^2}$.

5) A value of x for which the slope of the curve $y = \dfrac{x^3}{3} - \dfrac{3x^2}{2} + 2x + 1$ is zero is 5) ________

A) -1. B) 2. C) 3. D) 0. E) -2.

6) If $g(x) = x^4(2x - 1)^{10}$, then $g'(1) =$ 6) ________

A) 14. B) 80. C) 24. D) 0. E) 1.

7) If $f(x) = \dfrac{x^2 + 4}{x^2 - 2}$, then $f'(x) =$ 7) ________

A) $-\dfrac{12x}{(x^2 - 2)^2}$

B) $\dfrac{12x}{(x^2 + 2)^2}$

C) $\dfrac{6}{(x^2 - 2)^2}$

D) 1

E) $\dfrac{4x + 26x - 9x^2}{(3x + 2)^2}$

8) If $7x^2 + 4y^2 = 1$, then $\dfrac{dy}{dx} =$ 8) ________

A) $7x + 4y$. B) $\dfrac{1 - 14x}{8y}$. C) $14x + 8y$. D) $\dfrac{4y}{7x}$. E) $-\dfrac{7x}{4y}$.

9) If $f(x) = x^{3x + 1}$, then $f'(x) =$ 9) ________

A) $\dfrac{3x + 1}{x} + 3 \ln x$.

B) $(3x + 1)x^{3x}$.

C) $(2x + \ln x)x^{3x + 1}$.

D) $(\ln x)x^{3x}$.

E) $x^{3x + 1}\left[\dfrac{3x + 1}{x} + 3 \ln x\right]$.

10) The function $f(x) = x^2 - 6x + 8$ is decreasing on 10) ________

A) $(3, \infty)$.

B) $(-\infty, 3)$.

C) $(2, 4)$.

D) $(-\infty, 2)$ and $(4, \infty)$.

E) $(-3, 3)$.

11) The function $y = x^3 + 15x^2 - 33x$ has a relative maximum when $x =$ 11) ________

A) 11 B) 0. C) -1. D) -11. E) 1.

12) On the interval $[-1, 1]$, the function $y = 4 + x^2 - x^3$ has an absolute maximum when $x =$ 12) ________

A) -1. B) 1. C) $\dfrac{1}{2}$. D) 0. E) $-\dfrac{1}{2}$.

13) If $f(x) = x^4 - 6x^2 + 3$, then f has an inflection point when $x =$ 13) ________

A) 2. B) 3. C) $\sqrt{3}$. D) 0. E) 1.

14) An equation of a horizontal asymptote for the graph of $y = \frac{2x}{9x^2 - 1}$ is 14) ______

A) $x = \frac{2}{9}$. B) $x = \frac{1}{3}$. C) $y = 0$. D) $y = \frac{1}{3}$. E) $y = \frac{2}{9}$.

15) If $f(x) = x^3 - 7x^2 + 2x - 5$, then f is concave down on the interval 15) ______

A) $\left(-\infty, \frac{7}{3}\right)$. B) $\left(\frac{2}{3}, \infty\right)$. C) $\left(\frac{7}{3}, \infty\right)$. D) $\left(-\infty, \frac{2}{3}\right)$. E) $(-\infty, \infty)$.

16) If $f(x) = x^3 + 3x^2 - 24x + 8$, then f is 16) ______

A) increasing on $(2, \infty)$, concave up on $(-\infty, -1)$, and has a relative minimum when $x = 2$.
B) increasing on $(-4, 2)$, concave down on $(-\infty, \infty)$, and has a relative maximum when $x = 2$.
C) decreasing on $(-4, 2)$, concave down on $(-\infty, -1)$, and has a relative maximum when $x = -4$.
D) decreasing on $(1, 2)$, concave up $(0, \infty)$, and has a relative minimum when $x = -4$.
E) decreasing on $(-\infty, 4)$, concave up on $(-1, \infty)$, and has no relative minimum point.

17) If $y = x \ln x$, then $dy =$ 17) ______

A) $(x + \ln x)\, dx$.
B) $1 + \ln x$.
C) $x + \ln x$.
D) $(1 + \ln x)\, dx$.
E) none of the above

18) If $\frac{dy}{dx} = 3x^2 - 3 - 4e^{2x}$ and $y(0) = 8$, then $y =$ 18) ______

A) $x^3 - 3x - 2e^{2x} + 8$.
B) $x^3 - 3x - 2e^{2x}$.
C) 8.
D) $x^3 - 3x - 4e^{2x}$.
E) $x^3 - 3x - 2e^{2x} + 10$.

19) $\int e^{3x+4}\, dx =$ 19) ______

A) $\frac{e^{3x+5}}{3x + 5} + C$
B) $e^{3x+4} + C$
C) $(3x + 4)e^{3x+3} + C$
D) $\frac{1}{3}e^{3x+4} + C$
E) $3e^{3x+4} + C$

Evaluate the integral by using a substitution prior to integration by parts.

20) $\int \cos(\ln x)\,dx$ 20) ______

A) $x[\cos(\ln x) + \sin(\ln x)] + C$

B) $x\cos(\ln x) + \sin(\ln x) + C$

C) $\frac{x}{2}[\cos(\ln x) + \sin(\ln x)] + C$

D) $\frac{x}{2}[\cos(\ln x) - \sin(\ln x)] + C$

Provide an appropriate response.

21) $\int \frac{x^2 + 4x - 3}{x - 1}\,dx =$ 21) ______

A) $\frac{1}{3}\ln|x - 1| + C$

B) $\frac{x^2}{2} + 5x + 2\ln|x - 1| + C$

C) $\frac{x^2}{2} + 6x + 3\ln|x - 1| + C$

D) $\frac{7x^2}{2} - 2x + C$

E) $\frac{1}{2}\ln|x - 1| + C$

22) $\int \frac{4x}{x^2 + 1}\,dx =$ 22) ______

A) $\ln(x^2 + 1) + C$

B) $4\ln|x + 1| + C$

C) $\frac{1}{2}\ln(x^2 + 1) + C$

D) $\frac{2}{x} + C$

E) $2\ln(x^2 + 1) + C$

23) $\int_{-2}^{0} \frac{1}{\sqrt{1 - 4x}}\,dx =$ 23) ______

A) 1 B) 2 C) 3 D) 4 E) 5

24) $\int_{-1}^{0} 4(x + 1)e^{(x+1)^2}\,dx =$ 24) ______

A) $2(e - 1)$ B) $1 - e$ C) 0 D) $\frac{1}{2}(e - 1)$ E) $e(3e - 2)$

25) The exact area of the region bounded by the graphs of $y = x$ and $y = x^2$ is 25) ______

A) $\frac{5}{6}$ sq unit. B) $\frac{1}{6}$ sq unit. C) $\frac{1}{2}$ sq unit. D) $\frac{2}{3}$ sq unit. E) $\frac{1}{3}$ sq unit.

26) $\int_1^2 x\ln(x)\,dx =$ 26) ______

A) $2\ln(2) - \frac{3}{4}$ B) $\frac{\ln(2)^2}{4}$ C) $\ln(2) - 4$ D) $4\ln(2) - \frac{1}{4}$ E) $4\ln 2$

27) The function $f(x, y) = \frac{1}{3}x^3 + \frac{1}{2}y^2 + xy - 6x + 3$ has a relative minimum at 27) ______

A) (-2, 2). B) (2, -2). C) (2, 2). D) (3, -3). E) (-3, 3).

28) The number of critical points of $f(x, y) = x^2 + x^2y + y^2 - 2y + 2$ is 28) ______

A) 0. B) 1. C) 2. D) 3. E) 4.

Find all the first order partial derivatives for the following function.

29) $f(x,y,z) = xe^{(x^2 + y^2 + z^2)}$ 29) ______

A) $\frac{\partial f}{\partial x} = 2x^2e^{(x^2 + y^2 + z^2)}$; $\frac{\partial f}{\partial y} = xye^{(x^2 + y^2 + z^2)}$; $\frac{\partial f}{\partial z} = 2xze^{(x^2 + y^2 + z^2)}$

B) $\frac{\partial f}{\partial x} = (1 + 2x^2)\,e^{(x^2 + y^2 + z^2)}$; $\frac{\partial f}{\partial y} = xe^{(x^2 + y^2 + z^2)}$; $\frac{\partial f}{\partial z} = xe^{(x^2 + y^2 + z^2)}$

C) $\frac{\partial f}{\partial x} = (1 + 2x^2)\,e^{(x^2 + y^2 + z^2)}$; $\frac{\partial f}{\partial y} = xy^2e^{(x^2 + y^2 + z^2)}$; $\frac{\partial f}{\partial z} = xz^2e^{(x^2 + y^2 + z^2)}$

D) $\frac{\partial f}{\partial x} = (1 + 2x^2)\,e^{(x^2 + y^2 + z^2)}$; $\frac{\partial f}{\partial y} = 2xye^{(x^2 + y^2 + z^2)}$; $\frac{\partial f}{\partial z} = 2xze^{(x^2 + y^2 + z^2)}$

Find all the second order partial derivatives of the given function.

30) $f(x, y) = e^{x/y}$ 30) ______

A) $\frac{\partial^2 f}{\partial x^2} = \frac{e^{x/y}}{y^2}$; $\frac{\partial^2 f}{\partial y^2} = e^{x/y}\left(\frac{x^2 + 2xy}{y^3}\right)$; $\frac{\partial^2 f}{\partial y \partial x} = \frac{\partial^2 f}{\partial x \partial y} = -e^{x/y}\left(\frac{y + x}{y^3}\right)$

B) $\frac{\partial^2 f}{\partial x^2} = \frac{e^{x/y}}{y^2}$; $\frac{\partial^2 f}{\partial y^2} = e^{x/y}\left(\frac{x^2 + 2xy}{y^4}\right)$; $\frac{\partial^2 f}{\partial y \partial x} = \frac{\partial^2 f}{\partial x \partial y} = -e^{x/y}\left(\frac{y + x}{y^3}\right)$

C) $\frac{\partial^2 f}{\partial x^2} = \frac{e^{x/y}}{y^2}$; $\frac{\partial^2 f}{\partial y^2} = -e^{x/y}\left(\frac{x^2 + 2xy}{y^3}\right)$; $\frac{\partial^2 f}{\partial y \partial x} = \frac{\partial^2 f}{\partial x \partial y} = e^{x/y}\left(\frac{y + x}{y^3}\right)$

D) $\frac{\partial^2 f}{\partial x^2} = \frac{e^{x/y}}{y^2}$; $\frac{\partial^2 f}{\partial y^2} = \left(\frac{x^2 + 2xy}{y^4}\right)$; $\frac{\partial^2 f}{\partial y \partial x} = \frac{\partial^2 f}{\partial x \partial y} = \frac{y + x}{y^3}$