King Abdulaziz University

Faculty of Science
Department of Mathematics
Summer 2022

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General Instructions:

- Write your **full name** and **university ID** in the paper below.
- This exam paper contains **40** multiple choice questions each of **1.25 mark**.
- This exam is worth **50** % of your total grade.
- The time limit of the exam is **120 minuets**.
- **Completely circle** the correct answer in your answer sheet form by **PENCIL**.
- Please obey the rules provided by **invigilators**.
- The **cellphone** and **calculator** are not allowed during the exam.
- The exam is closed book**;** no form of external aid is allowed during the exam.
- Mere suspicion of **cheating** will be enough to get your test **withdrawn**.
- **Good luck** on your exam.

Name: _____

Section: _____

ID Number: _____

1. The function $f(x) = x^5 + 2x$ is

A. even

B. odd ✓

C. even and odd function

D. neither odd nor even function

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2. The equation of the normal line to the curve $y = x^3 - 2x$ at the point $(-1, 3)$ is

A. $y = -x + 4$

B. $y = x + 2$

C. $y = -x + 2$ ✓

D. $y = x + 4$

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3. $\lim_{x\to\infty} \dfrac{3x^2 - x - 2}{5x^2 + 4x + 1} =$

A. ∞

B. 0

C. $5/3$

D. $3/5$ ✓

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4. If $y = x^x$, then $y' =$

A. $x^x(1 - \ln x)$

B. $x^x(1 + \ln x)$ ✓

C. $x^x + \ln x$

D. $x^x - \ln x$

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5. If $f(x) = \ln(\sin x)$, then $f'(x) =$

A. $\sin x$

B. $\tan x$

C. $\cos x$

D. $\cot x$ ✓

6. If $f(x) = 10x^{-3} - 6x + 5$, then $f'(x) =$

A. $-30x^{-4} - 6$ ✓

B. $-30x^{-2} - 6$

C. $30x^{-4} - 6$

D. $30x^{-2} - 6$

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7. The definition of the derivative of a function $f(x)$ with respect to x is

A. $f'(x) = \lim_{h\to 0}(f(x+h) - f(x))$ if limit exists

B. $f'(x) = \lim_{h\to 0} \dfrac{f(x+h) - f(x)}{x+h}$ if limit exists

C. $f'(x) = \lim_{h\to 0} \dfrac{f(x+h) - f(x)}{h}$ if limit exists ✓

D. $f'(x) = \lim_{h\to 0} \dfrac{f(x-h) - f(x)}{h}$ if limit exists

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8. The function $f(x) = \frac{\sqrt{x-4}}{\sqrt{7-x}}$ is

A. algebraic ✓

B. rational

C. polynomial

D. root

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9. The domain of the function $f(x) = \sqrt[3]{x-1}$ is

A. $(-\infty, 1]$

B. $(1, \infty)$

C. $[1, \infty)$

D. $\mathbb{R}$ ✓

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10. If $f(x) = x^{-2/3}$, then $f'(x) = -\frac{2}{3\sqrt[3]{x^5}}$.

A. True ✓

B. False

11. If $y = \sin^{-1}(3x^2 + x)$, then $y' =$

A. $-\frac{6x+1}{\sqrt{1-(3x^2+x)^2}}$

B. $\frac{6x+1}{\sqrt{1-(3x^2+x)^2}}$ ✓

C. $\frac{6x+1}{\sqrt{1+(3x^2+x)^2}}$

D. $-\frac{6x+1}{\sqrt{1+(3x^2+x)^2}}$

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12. If the function $f(x) = \frac{2x-4}{x}$, then $f^{-1}(x) =$

A. $\frac{2}{x-2}$

B. $-\frac{2}{x-2}$

C. $\frac{4}{x-2}$

D. $-\frac{4}{x-2}$ ✓

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13. If $x^2 + y^2 = 4$, then $y' =$

A. $-\frac{y}{x}$

B. $-\frac{x}{y}$ ✓

C. $\frac{x}{y}$

D. $\frac{y}{x}$

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14. If $f(x) = \sqrt{3x^2 + 2}$, then $f'(x) =$

A. $\frac{6x}{\sqrt{3x^2+2}}$

B. $-\frac{3x}{\sqrt{3x^2+2}}$

C. $\frac{3x}{\sqrt{3x^2+2}}$ ✓

D. $-\frac{6x}{\sqrt{3x^2+2}}$

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15. $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$

A. True ✓

B. False

16. The function $f(x) = \ln(2x - 6)$ is continuous on

A. $(3, \infty)$ ✓

B. $[3, \infty)$

C. $(-\infty, 3]$

D. $(-\infty, 3)$

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17. $\lim_{x \to 3} \dfrac{x^2 - 9}{x - 3} =$

A. -6

B. 6

C. $1/3$

D. 3 ✓

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18. If $f(x) = \frac{x^2-2}{2x+1}$, then $f'(x) =$

A. $\frac{2x^2+2x+2}{(2x+1)^2}$

B. $\frac{2x^2+2x+4}{(2x+1)^2}$ ✓

C. $\frac{x^2+2x+4}{(2x+1)^2}$

D. $\frac{x^2+2x+1}{(2x+1)^2}$

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19. If $f(x) = e^x - x^3$, then $f^{(4)}(x) = e^x - 6$.

A. True

B. False ✓

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20. The range of the function $f(x) = \sin^{-1}(3x + 1)$ is

A. $[-\pi/2, \pi/2]$ ✓

B. $[-1, 1]$

C. $\mathbb{R}$

D. $(\pi/2, \pi/2)$

21. If $f(x) = (2x^2 - 4)^3$, then $f'(x) =$

A. $3x(2x^2 - 4)^2$

B. $12x(2x^2 - 4)^2$ ✓

C. $12x(2x^2 - 4)^3$

D. $3x(2x^2 - 4)^3$

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22. If $a > 0,\ a \neq 1$ and $g(x)$ is differentiable, then $\frac{d}{dx}[a^{g(x)}] =$

A. $a^{g(x)}\ g'(x)\ \ln a$ ✓

B. $a^{g(x)}\ g'(x)$

C. $-a^{g(x)}\ g'(x)\ \ln a$

D. $a^{g(x)}\ \ln a$

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23. If $f(x) = e^{\sin x}$, then $f'(x) =$

A. $-\cos x\ e^{\sin x}$

B. $\cos x\ e^{\sin x}$ ✓

C. $\sin x\ e^{\cos x}$

D. $-\sin x\ e^{\cos x}$

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24. The new graph of $f(x)$ that is shifted downward 3 units is

A. $f(x) - 3$ ✓

B. $f(x + 3)$

C. $f(x - 3)$

D. $f(x) + 3$

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25. The range of the function $f(x) = e^x - 3$ is

A. $(-3, \infty)$ ✓

B. $(0, \infty)$

C. $\mathbb{R}$

D. $\mathbb{R} - \{0\}$

26. If $f(x) = \log_2(2 + \cos x)$, then $f'(x) =$

A. $-\frac{\sin x}{(2+\cos x)\ln 2}$ ✓

B. $\frac{\sin x}{(2+\cos x)\ln 2}$

C. $-\frac{\sin x}{(2+\cos x)}$

D. $\frac{\sin x}{(2+\cos x)}$

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27. If $g(x)$ is differentiable, then $\frac{d}{dx}[\cot(g(x)] =$

A. $g'(x)\ \sec^2(g(x))$

B. $g'(x)\ \csc^2(g(x))$

C. $-g'(x)\ \csc^2(g(x))$ ✓

D. $-g'(x)\ \sec^2(g(x))$

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28. If $f(x) = \cos x$, then $f^{(27)}(x) =$

A. $\sin x$ ✓

B. $-\sin x$

C. $\cos x$

D. $-\cos x$

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29. $\lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^n =$

A. 1

B. ∞

C. e ✓

D. 0

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30. If $f(x) = e^x \cos x$, then $f'(x) =$

A. $-e^x(\cos x + \sin x)$

B. $e^x(\cos x + \sin x)$

C. $e^x(\cos x - \sin x)$ ✓

D. $-e^x(\cos x - \sin x)$

31. If $f(x) = x^2 - 1$ and $g(x) = x - 1$, then $(f - g)(x) =$

A. $x^2 + x - 2$

B. $x^2 + x$

C. $x^2 - x$ ✓

D. $x^2 + x + 2$

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32. The function $f(x) = \begin{cases} cx^2 + 2x & \text{if } x < 2 \\ x^3 - cx & \text{if } x \geq 2 \end{cases}$ is continuous everywhere if $c =$

A. $-\frac{2}{3}$

B. 2

C. $\frac{2}{3}$ ✓

D. 3

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33. If the function $f(x) = \begin{cases} x & \text{if } 0 \leq x \leq 1 \\ 4 - x & \text{if } 1 < x < 3 \end{cases}$, then $\lim_{x \to 1^-} f(x) =$

A. 3

B. 1 ✓

C. -1

D. does not exist

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34. If $x, y \in \mathbb{R}^+$, then $\log(xy) = \log(x) + \log(y)$

A. True ✓

B. False

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35. $\lim_{x \to 1^+} \dfrac{x + 3}{x - 1} =$

A. $-\infty$

B. 0

C. 1

D. ∞ ✓

36. The critical numbers of the function $f(x) = x^3 - 3x^2 - 9x + 1$ are

A. $x = -1,\ x = -3$

B. $x = 1,\ x = -3$

C. $x = -1,\ x = 3$ ✓

D. $x = 1,\ x = 3$

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37. The local maximum point of the function $f(x) = x^3 - 3x^2 - 9x + 1$ is

A. $(-1, 6)$ ✓

B. $(3, -26)$

C. $(1, -6)$

D. $(-3, -26)$

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38. The function $f(x) = x^3 - 3x^2 - 9x + 1$ is increasing on the interval

A. $(-3, -1)$

B. $(-\infty, -1) \cup (3, \infty)$ ✓

C. $(-\infty, -3) \cup (-1, \infty)$

D. $(-1, 3)$

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39. The function $f(x) = x^3 - 3x^2 - 9x + 1$ is concave up on the interval

A. $(1, \infty)$ ✓

B. $(-\infty, -1)$

C. $(-\infty, 1)$

D. $(-1, \infty)$

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40. The function $f(x) = x^3 - 3x^2 - 9x + 1$ has an inflection point at

A. $(1, 10)$

B. $(-1, -10)$

C. $(-1, 10)$

D. $(1, -10)$ ✓

♡ End of Exam ♡ **♡ All the best to you ♡**