King Fahd University of Petroleum & Minerals
Department of Mathematics and Statistics

Math 101
Final Exam
Term 102
Thursday, June 9, 2011

EXAM COVER

Number of versions: 4
Number of questions: 28
Number of Answers: 5 per question

King Fahd University of Petroleum & Minerals
Department of Mathematics and Statistics

Math 101
Final Exam
Term 102
Thursday, June 9, 2011
Net Time Allowed: 180 minutes

MASTER VERSION

1. If $x^2 + 1 \leq f(x) - 2x \leq 3x^4 - 1$ for all $x \in (-\infty, \infty)$, then $\lim_{x \to 1} f(x) =$

(a) 4

(b) -3

(c) 1

(d) 0

(e) Does not exist

2. The function $g(x) = \dfrac{\sqrt{x^2 - 4}}{x^2 - 3x}$ is **continuous** on

(a) $(-\infty, -2] \cup [2, 3) \cup (3, \infty)$

(b) $(-\infty, \infty)$

(c) $(-\infty, 0) \cup (0, 3) \cup (3, \infty)$

(d) $(-\infty, -2] \cup [2, \infty)$

(e) $[-2, 0) \cup (0, 2]$

3. $\lim_{x \to 0^-} \tan^{-1}(e^{1/x}) =$

(a) 0

(b) $\frac{\pi}{4}$

(c) $\frac{\pi}{2}$

(d) $-\frac{\pi}{2}$

(e) ∞

4. The equation of the **tangent line** to the curve $y = x^4 - 2x$ at $x = 1$ is

(a) $y = 2x - 3$

(b) $y = 3x - 4$

(c) $y = x - 2$

(d) $y = -4x + 3$

(e) $y = -2x + 1$

5. If $f(x) = \begin{cases} \cos x & \text{if } x \leq 0 \\ x^2 & \text{if } x > 0, \end{cases}$ then $f'(0) =$

(a) Does not exist

(b) 0

(c) 2

(d) -1

(e) 3

6. If $f(x) = \dfrac{1}{2+e^x}$, then $\displaystyle\lim_{h\to 0} \frac{f(x+h)-f(x)}{h} =$

(a) $\dfrac{-e^x}{(2+e^x)^2}$

(b) $\dfrac{1}{3}$

(c) $\dfrac{-2}{(2+e^x)^2}$

(d) $2+e^x$

(e) e^{-x}

7. Let $y = Ax^2 + Bx + C$. If

$$y'' + y' - 2y = x^2$$

then $A + B + C =$

(a) $-\frac{7}{4}$

(b) -1

(c) $\frac{3}{2}$

(d) $\frac{5}{7}$

(e) 0

8. The differential of $y = e^{\cot(\pi x)}$ is

(a) $dy = (-\pi \csc^2(\pi x) e^{\cot(\pi x)}) dx$

(b) $dy = (\sec^2(\pi x) e^{\cot(\pi x)}) dx$

(c) $dy = (-\pi \sec(\pi x) \tan(\pi x) e^{\cot(\pi x)}) dx$

(d) $dy = e^{\cot(\pi x)} dx$

(e) $dy = \cot(\pi x) dx$

9. The graph of $f(x) = \dfrac{x^2 - 5x + 6}{x^2 - 6x + 8}$ has

(a) one horizontal asymptote and one vertical asymptote

(b) one horizontal asymptote and two vertical asymptotes

(c) one slant asymptote and one vertical asymptote

(d) two horizontal asymptotes & two vertical asymptotes

(e) one slant asymptote and one horizontal asymptote

10. The polynomial $f(x) = 1 + 2x + 6x^2 - x^4$ is [CD: concave downward, CU: concave upward]

(a) CD on $(-\infty, -1)$ and $(1, \infty)$; CU on $(-1, 1)$

(b) CD on $(-\infty, 1)$; CU on $(1, \infty)$

(c) CD on $(-\infty, 2)$ and $(5, \infty)$; CU on $(2, \infty)$

(d) CD on $(-\infty, \infty)$

(e) CD on $(-3, 3)$; CU on $(-\infty, -3)$ and $(3, \infty)$

11. The **sum** of the critical numbrs of $f(x) = (x-1)^{3/5} \cdot (4-x)$ is

(a) $\frac{25}{8}$

(b) $\frac{17}{8}$

(c) $-\frac{9}{8}$

(d) 0

(e) $\frac{3}{7}$

12. If M and m are respectively the absolute maximum and absolute minimum values of $f(x) = \cos x + \sin x$ on $[0, \pi]$, then $\sqrt{2}\, M + m =$

(a) 1

(b) $2\sqrt{2}$

(c) 3

(d) 0

(e) -1

13. If $2x^2 + 3y^2 = 18$, then $y^3 y'' =$

(a) -4

(b) $\frac{8}{9}$

(c) $-\frac{1}{6}$

(d) 3

(e) -6

14. $\lim_{x \to 0} \frac{x - \tan x}{x - \sin x} =$

(a) -2

(b) 2

(c) 1

(d) -1

(e) 0

15. Using differentials (or a linear approximation), the value of $(64.018)^{2/3}$ is approximately equal to

(a) 16.003

(b) 16.01

(c) 4.003

(d) 16.018

(e) 12.002

16. Using Newton's Method to approximate one root of the equation $(x-2)^4 = \ln x$, we find that if $x_1 = 1$, then $x_2 =$

(a) $\frac{6}{5}$

(b) $\frac{4}{3}$

(c) $\frac{1}{2}$

(d) $\frac{2}{3}$

(e) $\frac{3}{5}$

17. If $f'(t) = 2t - 3\sin t$ and $f(0) = 5$, then $f(\pi) =$

(a) $\pi^2 - 1$

(b) $\pi^2 + 5$

(c) $\pi - 3$

(d) $\pi^2 + 2$

(e) 2π

18. Let a be a positive real number such that $a \neq e$. The **slope of the tangent line** to the curve $x^y = y^x$ at the point (a, a) is equal to

(a) 1

(b) $a \ln a$

(c) $\ln a - 1$

(d) $-a$

(e) a^2

19. The function $f(x) = \ln(x^2 - 3x + 2)$ has

(a) neither local minimum nor local maximum

(b) one local maximum and no local minimum

(c) one local maximum and two local minima

(d) one local minimum and two local maxima

(e) one local minimum and one local maximum

20. If $\sinh x + \cosh x = 5$, then $\tanh x =$

(a) $\dfrac{12}{13}$

(b) $\dfrac{1}{5}$

(c) $\dfrac{21}{25}$

(d) $\dfrac{3}{4}$

(e) $\dfrac{13}{16}$

21. $\frac{d}{dt}[\ln(\cosh t) - \frac{1}{2}\tanh^2 t] =$

(a) $\tanh^3 t$

(b) $\tanh t - \operatorname{sech}^2 t$

(c) 0

(d) $\coth t + \tanh t \operatorname{sech} t$

(e) $\tanh t - \tanh^2 t$

22. The function $f(x) = \frac{\sqrt{1-x^2}}{x}$ is

(a) decreasing on $(-1, 0)$ and on $(0, 1)$

(b) increasing on $(-1, 0)$ and on $(0, 1)$

(c) increasing on $(-1, 0)$ and decreasing on $(0, 1)$

(d) increasing on $(0, 1)$ and dcreasing on $(-1, 0)$

(e) decreasing on $(-\infty, \infty)$

23. $\lim_{x\to 0^+} (1 - 4\sin(3x))^{5\cot(9x)} =$

(a) $e^{-20/3}$

(b) $e^{-5/4}$

(c) e^{-20}

(d) $e^{-15/4}$

(e) 1

24. The equation of **the normal line** to the curve

$$y = x^4 - 10x + 11$$

that is parallel to the line $x - 6y = 3$ is

(a) $y = \frac{1}{6}x + \frac{11}{6}$

(b) $y = \frac{1}{6}x - \frac{5}{3}$

(c) $y = -6x - \frac{11}{6}$

(d) $y = -6x + 3$

(e) $y = -\frac{1}{6}x + \frac{1}{3}$

25. Two sides of a triangle are 5 m and 8 m in length and the angle between them is increasing at a rate of 0.3 rad/s. The rate at which **the area of the triangle** is increasing when the angle between the sides of fixed length is $\frac{\pi}{3}$ is

(a) 3 m^2/s

(b) 10 m^2/s

(c) 2.5 m^2/s

(d) 6.5 m^2/s

(e) 5 m^2/s

26. The sum of two positive numbers is 5. If the product P of the square of the first number and the cube of the second number is **maximized**, then $P =$

(a) 108

(b) 25

(c) 16

(d) 64

(e) 72

27. If $f(t) = 5 + 6\sin(3t)$, then $f^{(21)}\left(\frac{\pi}{3}\right) =$

(a) $-6 \cdot 3^{21}$

(b) 3^{21}

(c) 0

(d) $6 \cdot 3^{21}$

(e) $(21)!$

28. Applying the Mean Value Theorem to $f(x) = \tan^{-1} x$ on the interval $[1, 2]$, we conclude that

(a) $\frac{\pi}{4} + \frac{1}{5} < \tan^{-1} 2 < \frac{\pi}{4} + \frac{1}{2}$

(b) $\frac{\pi}{2} < \tan^{-1} 2 < \pi$

(c) $\frac{\pi}{4} + \frac{1}{2} < \tan^{-1} 2 < \frac{\pi}{2}$

(d) $\frac{1}{5} < \tan^{-1} 2 < \frac{1}{2}$

(e) $\frac{\pi}{8} < \tan^{-1} 2 < \frac{\pi}{4} + \frac{1}{5}$

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CODE 001 **Math 101** CODE 001

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1. The function $f(x) = \dfrac{\sqrt{1-x^2}}{x}$ is

(a) increasing on $(0, 1)$ and dcreasing on $(-1, 0)$

(b) increasing on $(-1, 0)$ and on $(0, 1)$

(c) increasing on $(-1, 0)$ and decreasing on $(0, 1)$

(d) decreasing on $(-1, 0)$ and on $(0, 1)$

(e) decreasing on $(-\infty, \infty)$

2. If $x^2 + 1 \leq f(x) - 2x \leq 3x^4 - 1$ for all $x \in (-\infty, \infty)$, then $\lim\limits_{x \to 1} f(x) =$

(a) 4

(b) Does not exist

(c) 1

(d) -3

(e) 0

3. Using Newton's Method to approximate one root of the equation $(x-2)^4 = \ln x$, we find that if $x_1 = 1$, then $x_2 =$

(a) $\frac{1}{2}$

(b) $\frac{3}{5}$

(c) $\frac{2}{3}$

(d) $\frac{6}{5}$

(e) $\frac{4}{3}$

4. If $2x^2 + 3y^2 = 18$, then $y^3 y'' =$

(a) $\frac{8}{9}$

(b) -4

(c) $-\frac{1}{6}$

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5. Using differentials (or a linear approximation), the value of $(64.018)^{2/3}$ is approximately equal to

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6. If $\sinh x + \cosh x = 5$, then $\tanh x =$

(a) $\frac{12}{13}$

(b) $\frac{13}{16}$

(c) $\frac{1}{5}$

(d) $\frac{3}{4}$

(e) $\frac{21}{25}$

7. If $f(x) = \begin{cases} \cos x & \text{if } x \leq 0 \\ x^2 & \text{if } x > 0, \end{cases}$ then $f'(0) =$

(a) 2

(b) Does not exist

(c) -1

(d) 0

(e) 3

8. The equation of the **tangent line** to the curve $y = x^4 - 2x$ at $x = 1$ is

(a) $y = x - 2$

(b) $y = 2x - 3$

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(d) $y = 3x - 4$

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(c) $(-\infty, -2] \cup [2, \infty)$

(d) $[-2, 0) \cup (0, 2]$

(e) $(-\infty, 0) \cup (0, 3) \cup (3, \infty)$

10. $\lim\limits_{x \to 0^-} \tan^{-1}(e^{1/x}) =$

(a) $-\dfrac{\pi}{2}$

(b) 0

(c) $\dfrac{\pi}{4}$

(d) $\dfrac{\pi}{2}$

(e) ∞

11. $\lim_{x \to 0} \frac{x - \tan x}{x - \sin x} =$

(a) -2

(b) 0

(c) 2

(d) 1

(e) -1

12. $\lim_{x \to 0^+} (1 - 4\sin(3x))^{5\cot(9x)} =$

(a) e^{-20}

(b) $e^{-20/3}$

(c) $e^{-15/4}$

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(e) 1

13. $\dfrac{d}{dt}[\ln(\cosh t) - \dfrac{1}{2}\tanh^2 t] =$

(a) $\tanh t - \tanh^2 t$

(b) 0

(c) $\tanh t - \operatorname{sech}^2 t$

(d) $\tanh^3 t$

(e) $\coth t + \tanh t \operatorname{sech} t$

14. Two sides of a triangle are 5 m and 8 m in length and the angle between them is increasing at a rate of 0.3 rad/s. The rate at which **the area of the triangle** is increasing when the angle between the sides of fixed length is $\dfrac{\pi}{3}$ is

(a) 10 m^2/s

(b) 3 m^2/s

(c) 2.5 m^2/s

(d) 5 m^2/s

(e) 6.5 m^2/s

15. The polynomial $f(x) = 1 + 2x + 6x^2 - x^4$ is [CD: concave downward, CU: concave upward]

(a) CD on $(-\infty, -1)$ and $(1, \infty)$; CU on $(-1, 1)$

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(c) CD on $(-\infty, \infty)$

(d) CD on $(-\infty, 2)$ and $(5, \infty)$; CU on $(2, \infty)$

(e) CD on $(-3, 3)$; CU on $(-\infty, -3)$ and $(3, \infty)$

16. The function $f(x) = \ln(x^2 - 3x + 2)$ has

(a) neither local minimum nor local maximum

(b) one local maximum and two local minima

(c) one local maximum and no local minimum

(d) one local minimum and two local maxima

(e) one local minimum and one local maximum

17. The sum of two positive numbers is 5. If the product P of the square of the first number and the cube of the second number is **maximized**, then $P =$

(a) 72

(b) 64

(c) 108

(d) 16

(e) 25

18. If M and m are respectively the absolute maximum and absolute minimum values of $f(x) = \cos x + \sin x$ on $[0, \pi]$, then $\sqrt{2}\,M + m =$

(a) 0

(b) $2\sqrt{2}$

(c) -1

(d) 1

(e) 3

19. Applying the Mean Value Theorem to $f(x) = \tan^{-1} x$ on the interval $[1, 2]$, we conclude that

(a) $\dfrac{\pi}{2} < \tan^{-1} 2 < \pi$

(b) $\dfrac{\pi}{8} < \tan^{-1} 2 < \dfrac{\pi}{4} + \dfrac{1}{5}$

(c) $\dfrac{\pi}{4} + \dfrac{1}{5} < \tan^{-1} 2 < \dfrac{\pi}{4} + \dfrac{1}{2}$

(d) $\dfrac{1}{5} < \tan^{-1} 2 < \dfrac{1}{2}$

(e) $\dfrac{\pi}{4} + \dfrac{1}{2} < \tan^{-1} 2 < \dfrac{\pi}{2}$

20. If $f'(t) = 2t - 3\sin t$ and $f(0) = 5$, then $f(\pi) =$

(a) $\pi - 3$

(b) $\pi^2 - 1$

(c) $\pi^2 + 2$

(d) $\pi^2 + 5$

(e) 2π

21. The equation of **the normal line** to the curve

$$y = x^4 - 10x + 11$$

that is parallel to the line $x - 6y = 3$ is

(a) $y = -6x - \dfrac{11}{6}$

(b) $y = -\dfrac{1}{6}x + \dfrac{1}{3}$

(c) $y = \dfrac{1}{6}x + \dfrac{11}{6}$

(d) $y = \dfrac{1}{6}x - \dfrac{5}{3}$

(e) $y = -6x + 3$

22. The **sum** of the critical numbrs of $f(x) = (x-1)^{3/5} \cdot (4-x)$ is

(a) $\dfrac{3}{7}$

(b) $\dfrac{25}{8}$

(c) $\dfrac{17}{8}$

(d) 0

(e) $-\dfrac{9}{8}$

23. If $f(t) = 5 + 6\sin(3t)$, then $f^{(21)}\left(\dfrac{\pi}{3}\right) =$

(a) $-6 \cdot 3^{21}$

(b) $6 \cdot 3^{21}$

(c) 0

(d) 3^{21}

(e) $(21)!$

24. If $f(x) = \dfrac{1}{2 + e^x}$, then $\lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h} =$

(a) $\dfrac{-2}{(2 + e^x)^2}$

(b) $2 + e^x$

(c) e^{-x}

(d) $\dfrac{1}{3}$

(e) $\dfrac{-e^x}{(2 + e^x)^2}$

25. The graph of $f(x) = \dfrac{x^2 - 5x + 6}{x^2 - 6x + 8}$ has

(a) one horizontal asymptote and one vertical asymptote

(b) one horizontal asymptote and two vertical asymptotes

(c) two horizontal asymptotes & two vertical asymptotes

(d) one slant asymptote and one vertical asymptote

(e) one slant asymptote and one horizontal asymptote

26. Let $y = Ax^2 + Bx + C$. If

$$y'' + y' - 2y = x^2$$

then $A + B + C =$

(a) $-\dfrac{7}{4}$

(b) $\dfrac{3}{2}$

(c) -1

(d) $\dfrac{5}{7}$

(e) 0

27. The differential of $y = e^{\cot(\pi x)}$ is

(a) $dy = (\sec^2(\pi x) e^{\cot(\pi x)})dx$

(b) $dy = (-\pi \csc^2(\pi x) e^{\cot(\pi x)})dx$

(c) $dy = \cot(\pi x)dx$

(d) $dy = (-\pi \sec(\pi x) \tan(\pi x) e^{\cot(\pi x)})dx$

(e) $dy = e^{\cot(\pi x)}dx$

28. Let a be a positive real number such that $a \neq e$. The **slope of the tangent line** to the curve $x^y = y^x$ at the point (a, a) is equal to

(a) $a \ln a$

(b) $-a$

(c) $\ln a - 1$

(d) a^2

(e) 1

Name ....

ID .... Sec ....

1	a	b	c	d	e	f
2	a	b	c	d	e	f
3	a	b	c	d	e	f
4	a	b	c	d	e	f
5	a	b	c	d	e	f
6	a	b	c	d	e	f
7	a	b	c	d	e	f
8	a	b	c	d	e	f
9	a	b	c	d	e	f
10	a	b	c	d	e	f
11	a	b	c	d	e	f
12	a	b	c	d	e	f
13	a	b	c	d	e	f
14	a	b	c	d	e	f
15	a	b	c	d	e	f
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36	a	b	c	d	e	f
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48	a	b	c	d	e	f
49	a	b	c	d	e	f
50	a	b	c	d	e	f
51	a	b	c	d	e	f
52	a	b	c	d	e	f
53	a	b	c	d	e	f
54	a	b	c	d	e	f
55	a	b	c	d	e	f
56	a	b	c	d	e	f
57	a	b	c	d	e	f
58	a	b	c	d	e	f
59	a	b	c	d	e	f
60	a	b	c	d	e	f
61	a	b	c	d	e	f
62	a	b	c	d	e	f
63	a	b	c	d	e	f
64	a	b	c	d	e	f
65	a	b	c	d	e	f
66	a	b	c	d	e	f
67	a	b	c	d	e	f
68	a	b	c	d	e	f
69	a	b	c	d	e	f
70	a	b	c	d	e	f

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CODE 002 **Math 101** CODE 002

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1. $\lim_{x\to 0} \dfrac{x - \tan x}{x - \sin x} =$

(a) 2

(b) 1

(c) 0

(d) -2

(e) -1

2. $\dfrac{d}{dt}[\ln(\cosh t) - \dfrac{1}{2}\tanh^2 t] =$

(a) $\coth t + \tanh t \text{ sech } t$

(b) $\tanh^3 t$

(c) 0

(d) $\tanh t - \tanh^2 t$

(e) $\tanh t - \text{sech}^2\, t$

3. Two sides of a triangle are 5 m and 8 m in length and the angle between them is increasing at a rate of 0.3 rad/s. The rate at which **the area of the triangle** is increasing when the angle between the sides of fixed length is $\frac{\pi}{3}$ is

(a) 10 m^2/s

(b) 6.5 m^2/s

(c) 5 m^2/s

(d) 3 m^2/s

(e) 2.5 m^2/s

4. The **sum** of the critical numbrs of $f(x) = (x-1)^{3/5} \cdot (4-x)$ is

(a) $-\frac{9}{8}$

(b) $\frac{25}{8}$

(c) $\frac{3}{7}$

(d) 0

(e) $\frac{17}{8}$

5. $\lim_{x \to 0^-} \tan^{-1}(e^{1/x}) =$

(a) 0

(b) ∞

(c) $\frac{\pi}{2}$

(d) $\frac{\pi}{4}$

(e) $-\frac{\pi}{2}$

6. The sum of two positive numbers is 5. If the product P of the square of the first number and the cube of the second number is **maximized**, then $P =$

(a) 108

(b) 64

(c) 25

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7. The differential of $y = e^{\cot(\pi x)}$ is

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(c) $dy = (-\pi \sec(\pi x)\tan(\pi x)e^{\cot(\pi x)})dx$

(d) $dy = \cot(\pi x)dx$

(e) $dy = e^{\cot(\pi x)}dx$

8. The graph of $f(x) = \dfrac{x^2 - 5x + 6}{x^2 - 6x + 8}$ has

(a) two horizontal asymptotes & two vertical asymptotes

(b) one slant asymptote and one vertical asymptote

(c) one slant asymptote and one horizontal asymptote

(d) one horizontal asymptote and two vertical asymptotes

(e) one horizontal asymptote and one vertical asymptote

9. If $x^2 + 1 \leq f(x) - 2x \leq 3x^4 - 1$ for all $x \in (-\infty, \infty)$, then $\lim_{x \to 1} f(x) =$

(a) -3

(b) 0

(c) 1

(d) Does not exist

(e) 4

10. If $\sinh x + \cosh x = 5$, then $\tanh x =$

(a) $\frac{3}{4}$

(b) $\frac{21}{25}$

(c) $\frac{12}{13}$

(d) $\frac{13}{16}$

(e) $\frac{1}{5}$

11. If M and m are respectively the absolute maximum and absolute minimum values of $f(x) = \cos x + \sin x$ on $[0, \pi]$, then $\sqrt{2}\, M + m =$

(a) 1

(b) 0

(c) $2\sqrt{2}$

(d) -1

(e) 3

12. The polynomial $f(x) = 1 + 2x + 6x^2 - x^4$ is [CD: concave downward, CU: concave upward]

(a) CD on $(-\infty, -1)$ and $(1, \infty)$; CU on $(-1, 1)$

(b) CD on $(-\infty, 2)$ and $(5, \infty)$; CU on $(2, \infty)$

(c) CD on $(-3, 3)$; CU on $(-\infty, -3)$ and $(3, \infty)$

(d) CD on $(-\infty, 1)$; CU on $(1, \infty)$

(e) CD on $(-\infty, \infty)$

13. The function $f(x) = \ln(x^2 - 3x + 2)$ has

(a) one local minimum and one local maximum

(b) one local maximum and no local minimum

(c) one local maximum and two local minima

(d) neither local minimum nor local maximum

(e) one local minimum and two local maxima

14. Let a be a positive real number such that $a \neq e$. The **slope of the tangent line** to the curve $x^y = y^x$ at the point (a, a) is equal to

(a) $a \ln a$

(b) 1

(c) $-a$

(d) $\ln a - 1$

(e) a^2

15. The function $g(x) = \dfrac{\sqrt{x^2-4}}{x^2-3x}$ is **continuous** on

(a) $(-\infty, \infty)$

(b) $[-2, 0) \cup (0, 2]$

(c) $(-\infty, -2] \cup [2, \infty)$

(d) $(-\infty, 0) \cup (0, 3) \cup (3, \infty)$

(e) $(-\infty, -2] \cup [2, 3) \cup (3, \infty)$

16. If $f(x) = \begin{cases} \cos x & \text{if } x \leq 0 \\ x^2 & \text{if } x > 0, \end{cases}$ then $f'(0) =$

(a) 2

(b) Does not exist

(c) 0

(d) -1

(e) 3

17. Using Newton's Method to approximate one root of the equation $(x-2)^4 = \ln x$, we find that if $x_1 = 1$, then $x_2 =$

(a) $\frac{2}{3}$

(b) $\frac{1}{2}$

(c) $\frac{4}{3}$

(d) $\frac{3}{5}$

(e) $\frac{6}{5}$

18. The equation of the **tangent line** to the curve $y = x^4 - 2x$ at $x = 1$ is

(a) $y = 2x - 3$

(b) $y = -4x + 3$

(c) $y = 3x - 4$

(d) $y = x - 2$

(e) $y = -2x + 1$

19. Let $y = Ax^2 + Bx + C$. If

$$y'' + y' - 2y = x^2$$

then $A + B + C =$

(a) $-\frac{7}{4}$

(b) $\frac{3}{2}$

(c) $\frac{5}{7}$

(d) 0

(e) -1

20. The function $f(x) = \frac{\sqrt{1-x^2}}{x}$ is

(a) increasing on $(0, 1)$ and dcreasing on $(-1, 0)$

(b) decreasing on $(-\infty, \infty)$

(c) decreasing on $(-1, 0)$ and on $(0, 1)$

(d) increasing on $(-1, 0)$ and decreasing on $(0, 1)$

(e) increasing on $(-1, 0)$ and on $(0, 1)$

21. If $f(x) = \dfrac{1}{2+e^x}$, then $\lim\limits_{h\to 0} \dfrac{f(x+h)-f(x)}{h} =$

(a) e^{-x}

(b) $\dfrac{-e^x}{(2+e^x)^2}$

(c) $2+e^x$

(d) $\dfrac{-2}{(2+e^x)^2}$

(e) $\dfrac{1}{3}$

22. Applying the Mean Value Theorem to $f(x) = \tan^{-1} x$ on the interval $[1, 2]$, we conclude that

(a) $\dfrac{\pi}{4} + \dfrac{1}{2} < \tan^{-1} 2 < \dfrac{\pi}{2}$

(b) $\dfrac{1}{5} < \tan^{-1} 2 < \dfrac{1}{2}$

(c) $\dfrac{\pi}{8} < \tan^{-1} 2 < \dfrac{\pi}{4} + \dfrac{1}{5}$

(d) $\dfrac{\pi}{2} < \tan^{-1} 2 < \pi$

(e) $\dfrac{\pi}{4} + \dfrac{1}{5} < \tan^{-1} 2 < \dfrac{\pi}{4} + \dfrac{1}{2}$

23. If $2x^2 + 3y^2 = 18$, then $y^3y'' =$

(a) -4

(b) 3

(c) -6

(d) $-\dfrac{1}{6}$

(e) $\dfrac{8}{9}$

24. The equation of **the normal line** to the curve

$$y = x^4 - 10x + 11$$

that is parallel to the line $x - 6y = 3$ is

(a) $y = -6x + 3$

(b) $y = \dfrac{1}{6}x + \dfrac{11}{6}$

(c) $y = \dfrac{1}{6}x - \dfrac{5}{3}$

(d) $y = -\dfrac{1}{6}x + \dfrac{1}{3}$

(e) $y = -6x - \dfrac{11}{6}$

25. If $f(t) = 5 + 6\sin(3t)$, then $f^{(21)}\left(\frac{\pi}{3}\right) =$

(a) $(21)!$

(b) $6 \cdot 3^{21}$

(c) $-6 \cdot 3^{21}$

(d) 0

(e) 3^{21}

26. $\lim\limits_{x\to 0^+} (1 - 4\sin(3x))^{5\cot(9x)} =$

(a) $e^{-5/4}$

(b) $e^{-15/4}$

(c) 1

(d) e^{-20}

(e) $e^{-20/3}$

27. Using differentials (or a linear approximation), the value of $(64.018)^{2/3}$ is approximately equal to

(a) 16.003

(b) 12.002

(c) 16.01

(d) 16.018

(e) 4.003

28. If $f'(t) = 2t - 3\sin t$ and $f(0) = 5$, then $f(\pi) =$

(a) $\pi^2 + 2$

(b) 2π

(c) $\pi^2 + 5$

(d) $\pi^2 - 1$

(e) $\pi - 3$

Name ....

ID .... Sec ....

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67	a	b	c	d	e	f
68	a	b	c	d	e	f
69	a	b	c	d	e	f
70	a	b	c	d	e	f

King Fahd University of Petroleum & Minerals
Department of Mathematics and Statistics

CODE 003 **Math 101** **CODE 003**

Math 101
Final Exam
Term 102
Thursday, June 9, 2011
Net Time Allowed: 180 minutes

Name: ______________________________

ID: ____________________ Sec: ____________________.

Check that this exam has 28 questions.

Important Instructions:

1. All types of calculators, pagers or mobile phones are NOT allowed during the examination.
2. Use HB 2.5 pencils only.
3. Use a good eraser. DO NOT use the erasers attached to the pencil.
4. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.
5. When bubbling your ID number and Section number, be sure that the bubbles match with the numbers that you write.
6. The Test Code Number is already bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.
7. When bubbling, make sure that the bubbled space is fully covered.
8. When erasing a bubble, make sure that you do not leave any trace of penciling.

1. The function $g(x) = \dfrac{\sqrt{x^2-4}}{x^2-3x}$ is **continuous** on

(a) $(-\infty,-2] \cup [2,\infty)$

(b) $(-\infty,0) \cup (0,3) \cup (3,\infty)$

(c) $[-2,0) \cup (0,2]$

(d) $(-\infty,-2] \cup [2,3) \cup (3,\infty)$

(e) $(-\infty,\infty)$

2. If $\sinh x + \cosh x = 5$, then $\tanh x =$

(a) $\dfrac{12}{13}$

(b) $\dfrac{1}{5}$

(c) $\dfrac{3}{4}$

(d) $\dfrac{13}{16}$

(e) $\dfrac{21}{25}$

3. Applying the Mean Value Theorem to $f(x) = \tan^{-1} x$ on the interval $[1, 2]$, we conclude that

(a) $\frac{\pi}{2} < \tan^{-1} 2 < \pi$

(b) $\frac{\pi}{4} + \frac{1}{2} < \tan^{-1} 2 < \frac{\pi}{2}$

(c) $\frac{\pi}{4} + \frac{1}{5} < \tan^{-1} 2 < \frac{\pi}{4} + \frac{1}{2}$

(d) $\frac{\pi}{8} < \tan^{-1} 2 < \frac{\pi}{4} + \frac{1}{5}$

(e) $\frac{1}{5} < \tan^{-1} 2 < \frac{1}{2}$

4. If $x^2 + 1 \leq f(x) - 2x \leq 3x^4 - 1$ for all $x \in (-\infty, \infty)$, then $\lim_{x \to 1} f(x) =$

(a) 4

(b) 1

(c) -3

(d) 0

(e) Does not exist

5. The equation of **the normal line** to the curve

$$y = x^4 - 10x + 11$$

that is parallel to the line $x - 6y = 3$ is

(a) $y = -\dfrac{1}{6}x + \dfrac{1}{3}$

(b) $y = \dfrac{1}{6}x + \dfrac{11}{6}$

(c) $y = \dfrac{1}{6}x - \dfrac{5}{3}$

(d) $y = -6x + 3$

(e) $y = -6x - \dfrac{11}{6}$

6. $\displaystyle\lim_{x\to 0} \frac{x - \tan x}{x - \sin x} =$

(a) 0

(b) 1

(c) -2

(d) -1

(e) 2

7. The differential of $y = e^{\cot(\pi x)}$ is

(a) $dy = e^{\cot(\pi x)} dx$

(b) $dy = (\sec^2(\pi x) e^{\cot(\pi x)}) dx$

(c) $dy = (-\pi \sec(\pi x) \tan(\pi x) e^{\cot(\pi x)}) dx$

(d) $dy = \cot(\pi x) dx$

(e) $dy = (-\pi \csc^2(\pi x) e^{\cot(\pi x)}) dx$

8. Let $y = Ax^2 + Bx + C$. If

$$y'' + y' - 2y = x^2$$

then $A + B + C =$

(a) $\dfrac{3}{2}$

(b) $\dfrac{5}{7}$

(c) $-\dfrac{7}{4}$

(d) 0

(e) -1

9. $\lim_{x\to 0^-} \tan^{-1}(e^{1/x}) =$

(a) $-\frac{\pi}{2}$

(b) ∞

(c) 0

(d) $\frac{\pi}{2}$

(e) $\frac{\pi}{4}$

10. The function $f(x) = \frac{\sqrt{1-x^2}}{x}$ is

(a) increasing on $(0, 1)$ and dcreasing on $(-1, 0)$

(b) decreasing on $(-1, 0)$ and on $(0, 1)$

(c) increasing on $(-1, 0)$ and decreasing on $(0, 1)$

(d) increasing on $(-1, 0)$ and on $(0, 1)$

(e) decreasing on $(-\infty, \infty)$

11. Two sides of a triangle are $5\,\text{m}$ and $8\,\text{m}$ in length and the angle between them is increasing at a rate of $0.3\,\text{rad/s}$. The rate at which **the area of the triangle** is increasing when the angle between the sides of fixed length is $\dfrac{\pi}{3}$ is

(a) $2.5\ \text{m}^2/\text{s}$

(b) $3\ \text{m}^2/\text{s}$

(c) $10\ \text{m}^2/\text{s}$

(d) $5\ \text{m}^2/\text{s}$

(e) $6.5\ \text{m}^2/\text{s}$

12. If $f(t) = 5 + 6\sin(3t)$, then $f^{(21)}\left(\dfrac{\pi}{3}\right) =$

(a) $-6 \cdot 3^{21}$

(b) 3^{21}

(c) $(21)!$

(d) 0

(e) $6 \cdot 3^{21}$

13. The **sum** of the critical numbrs of $f(x) = (x-1)^{3/5} \cdot (4-x)$ is

(a) 0

(b) $\dfrac{25}{8}$

(c) $\dfrac{3}{7}$

(d) $-\dfrac{9}{8}$

(e) $\dfrac{17}{8}$

14. The sum of two positive numbers is 5. If the product P of the square of the first number and the cube of the second number is **maximized**, then $P =$

(a) 72

(b) 25

(c) 16

(d) 64

(e) 108

15. The polynomial $f(x) = 1 + 2x + 6x^2 - x^4$ is [CD: concave downward, CU: concave upward]

(a) CD on $(-3, 3)$; CU on $(-\infty, -3)$ and $(3, \infty)$

(b) CD on $(-\infty, 2)$ and $(5, \infty)$; CU on $(2, \infty)$

(c) CD on $(-\infty, -1)$ and $(1, \infty)$; CU on $(-1, 1)$

(d) CD on $(-\infty, \infty)$

(e) CD on $(-\infty, 1)$; CU on $(1, \infty)$

16. $\dfrac{d}{dt}[\ln(\cosh t) - \dfrac{1}{2}\tanh^2 t] =$

(a) $\tanh t - \operatorname{sech}^2 t$

(b) 0

(c) $\coth t + \tanh t \operatorname{sech} t$

(d) $\tanh t - \tanh^2 t$

(e) $\tanh^3 t$

17. If $f'(t) = 2t - 3\sin t$ and $f(0) = 5$, then $f(\pi) =$

(a) 2π

(b) $\pi^2 + 5$

(c) $\pi - 3$

(d) $\pi^2 + 2$

(e) $\pi^2 - 1$

18. Using Newton's Method to approximate one root of the equation $(x-2)^4 = \ln x$, we find that if $x_1 = 1$, then $x_2 =$

(a) $\frac{1}{2}$

(b) $\frac{2}{3}$

(c) $\frac{3}{5}$

(d) $\frac{4}{3}$

(e) $\frac{6}{5}$

19. The function $f(x) = \ln(x^2 - 3x + 2)$ has

(a) neither local minimum nor local maximum

(b) one local minimum and two local maxima

(c) one local maximum and two local minima

(d) one local minimum and one local maximum

(e) one local maximum and no local minimum

20. If $2x^2 + 3y^2 = 18$, then $y^3y'' =$

(a) -4

(b) $\dfrac{8}{9}$

(c) 3

(d) -6

(e) $-\dfrac{1}{6}$

21. If M and m are respectively the absolute maximum and absolute minimum values of $f(x) = \cos x + \sin x$ on $[0, \pi]$, then $\sqrt{2}\,M + m =$

(a) 0

(b) 1

(c) 3

(d) -1

(e) $2\sqrt{2}$

22. Let a be a positive real number such that $a \neq e$. The **slope of the tangent line** to the curve $x^y = y^x$ at the point (a, a) is equal to

(a) $\ln a - 1$

(b) $-a$

(c) $a \ln a$

(d) 1

(e) a^2

23. Using differentials (or a linear approximation), the value of $(64.018)^{2/3}$ is approximately equal to

(a) 16.01

(b) 4.003

(c) 16.003

(d) 16.018

(e) 12.002

24. The graph of $f(x) = \dfrac{x^2 - 5x + 6}{x^2 - 6x + 8}$ has

(a) one slant asymptote and one horizontal asymptote

(b) one horizontal asymptote and two vertical asymptotes

(c) one horizontal asymptote and one vertical asymptote

(d) two horizontal asymptotes & two vertical asymptotes

(e) one slant asymptote and one vertical asymptote

25. If $f(x) = \begin{cases} \cos x & \text{if } x \leq 0 \\ x^2 & \text{if } x > 0, \end{cases}$ then $f'(0) =$

(a) 3

(b) Does not exist

(c) -1

(d) 0

(e) 2

26. The equation of the **tangent line** to the curve $y = x^4 - 2x$ at $x = 1$ is

(a) $y = x - 2$

(b) $y = 2x - 3$

(c) $y = -2x + 1$

(d) $y = -4x + 3$

(e) $y = 3x - 4$

27. $\lim\limits_{x \to 0^+} (1 - 4\sin(3x))^{5\cot(9x)} =$

(a) 1

(b) $e^{-5/4}$

(c) $e^{-20/3}$

(d) $e^{-15/4}$

(e) e^{-20}

28. If $f(x) = \dfrac{1}{2 + e^x}$, then $\lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h} =$

(a) $\dfrac{1}{3}$

(b) $\dfrac{-e^x}{(2 + e^x)^2}$

(c) e^{-x}

(d) $\dfrac{-2}{(2 + e^x)^2}$

(e) $2 + e^x$

Name ....

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King Fahd University of Petroleum & Minerals
Department of Mathematics and Statistics

CODE 004 **Math 101** CODE 004

Math 101
Final Exam
Term 102
Thursday, June 9, 2011
Net Time Allowed: 180 minutes

Name: ______________________________

ID: ____________________ Sec: ____________________.

Check that this exam has 28 questions.

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1. The function $f(x) = \ln(x^2 - 3x + 2)$ has

(a) one local maximum and no local minimum

(b) one local minimum and two local maxima

(c) neither local minimum nor local maximum

(d) one local maximum and two local minima

(e) one local minimum and one local maximum

2. $\dfrac{d}{dt}[\ln(\cosh t) - \dfrac{1}{2}\tanh^2 t] =$

(a) $\tanh t - \tanh^2 t$

(b) $\tanh t - \text{sech}^2\, t$

(c) $\coth t + \tanh t \text{ sech } t$

(d) $\tanh^3 t$

(e) 0

3. If $f'(t) = 2t - 3\sin t$ and $f(0) = 5$, then $f(\pi) =$

(a) $\pi - 3$

(b) $\pi^2 + 5$

(c) $\pi^2 + 2$

(d) $\pi^2 - 1$

(e) 2π

4. Using Newton's Method to approximate one root of the equation $(x-2)^4 = \ln x$, we find that if $x_1 = 1$, then $x_2 =$

(a) $\dfrac{6}{5}$

(b) $\dfrac{4}{3}$

(c) $\dfrac{2}{3}$

(d) $\dfrac{3}{5}$

(e) $\dfrac{1}{2}$

5. The equation of **the normal line** to the curve

$$y = x^4 - 10x + 11$$

that is parallel to the line $x - 6y = 3$ is

(a) $y = \frac{1}{6}x + \frac{11}{6}$

(b) $y = -\frac{1}{6}x + \frac{1}{3}$

(c) $y = -6x + 3$

(d) $y = -6x - \frac{11}{6}$

(e) $y = \frac{1}{6}x - \frac{5}{3}$

6. Let $y = Ax^2 + Bx + C$. If

$$y'' + y' - 2y = x^2$$

then $A + B + C =$

(a) -1

(b) $\frac{5}{7}$

(c) $\frac{3}{2}$

(d) $-\frac{7}{4}$

(e) 0

7. If $f(x) = \begin{cases} \cos x & \text{if } x \leq 0 \\ x^2 & \text{if } x > 0, \end{cases}$ then $f'(0) =$

(a) 2

(b) 3

(c) Does not exist

(d) 0

(e) -1

8. If $f(t) = 5 + 6\sin(3t)$, then $f^{(21)}\left(\frac{\pi}{3}\right) =$

(a) 3^{21}

(b) 0

(c) $-6 \cdot 3^{21}$

(d) $(21)!$

(e) $6 \cdot 3^{21}$

9. The polynomial $f(x) = 1 + 2x + 6x^2 - x^4$ is [CD: concave downward, CU: concave upward]

(a) CD on $(-3, 3)$; CU on $(-\infty, -3)$ and $(3, \infty)$

(b) CD on $(-\infty, \infty)$

(c) CD on $(-\infty, -1)$ and $(1, \infty)$; CU on $(-1, 1)$

(d) CD on $(-\infty, 1)$; CU on $(1, \infty)$

(e) CD on $(-\infty, 2)$ and $(5, \infty)$; CU on $(2, \infty)$

10. If $2x^2 + 3y^2 = 18$, then $y^3 y'' =$

(a) 3

(b) -4

(c) $-\frac{1}{6}$

(d) $\frac{8}{9}$

(e) -6

11. The function $g(x) = \dfrac{\sqrt{x^2 - 4}}{x^2 - 3x}$ is **continuous** on

(a) $(-\infty, \infty)$

(b) $[-2, 0) \cup (0, 2]$

(c) $(-\infty, 0) \cup (0, 3) \cup (3, \infty)$

(d) $(-\infty, -2] \cup [2, \infty)$

(e) $(-\infty, -2] \cup [2, 3) \cup (3, \infty)$

12. Two sides of a triangle are 5 m and 8 m in length and the angle between them is increasing at a rate of 0.3 rad/s. The rate at which **the area of the triangle** is increasing when the angle between the sides of fixed length is $\dfrac{\pi}{3}$ is

(a) 10 m^2/s

(b) 3 m^2/s

(c) 5 m^2/s

(d) 6.5 m^2/s

(e) 2.5 m^2/s

13. $\lim_{x\to 0^+} (1 - 4\sin(3x))^{5\cot(9x)} =$

(a) $e^{-20/3}$

(b) $e^{-15/4}$

(c) 1

(d) $e^{-5/4}$

(e) e^{-20}

14. The equation of the **tangent line** to the curve $y = x^4 - 2x$ at $x = 1$ is

(a) $y = -4x + 3$

(b) $y = x - 2$

(c) $y = 2x - 3$

(d) $y = 3x - 4$

(e) $y = -2x + 1$

15. The differential of $y = e^{\cot(\pi x)}$ is

(a) $dy = \cot(\pi x)dx$

(b) $dy = (-\pi \csc^2(\pi x)e^{\cot(\pi x)})dx$

(c) $dy = (-\pi \sec(\pi x)\tan(\pi x)e^{\cot(\pi x)})dx$

(d) $dy = e^{\cot(\pi x)}dx$

(e) $dy = (\sec^2(\pi x)e^{\cot(\pi x)})dx$

16. The function $f(x) = \dfrac{\sqrt{1-x^2}}{x}$ is

(a) increasing on $(-1, 0)$ and decreasing on $(0, 1)$

(b) increasing on $(-1, 0)$ and on $(0, 1)$

(c) increasing on $(0, 1)$ and dcreasing on $(-1, 0)$

(d) decreasing on $(-\infty, \infty)$

(e) decreasing on $(-1, 0)$ and on $(0, 1)$

17. If $x^2 + 1 \leq f(x) - 2x \leq 3x^4 - 1$ for all $x \in (-\infty, \infty)$, then $\lim\limits_{x\to 1} f(x) =$

(a) 4

(b) 0

(c) Does not exist

(d) 1

(e) -3

18. If M and m are respectively the absolute maximum and absolute minimum values of $f(x) = \cos x + \sin x$ on $[0, \pi]$, then $\sqrt{2}\, M + m =$

(a) -1

(b) $2\sqrt{2}$

(c) 3

(d) 0

(e) 1

19. Using differentials (or a linear approximation), the value of $(64.018)^{2/3}$ is approximately equal to

(a) 4.003

(b) 16.003

(c) 16.018

(d) 16.01

(e) 12.002

20. The graph of $f(x) = \dfrac{x^2 - 5x + 6}{x^2 - 6x + 8}$ has

(a) one horizontal asymptote and two vertical asymptotes

(b) one slant asymptote and one horizontal asymptote

(c) two horizontal asymptotes & two vertical asymptotes

(d) one slant asymptote and one vertical asymptote

(e) one horizontal asymptote and one vertical asymptote

21. $\lim_{x\to 0^-} \tan^{-1}(e^{1/x}) =$

(a) $\dfrac{\pi}{2}$

(b) $\dfrac{\pi}{4}$

(c) 0

(d) ∞

(e) $-\dfrac{\pi}{2}$

22. Applying the Mean Value Theorem to $f(x) = \tan^{-1} x$ on the interval $[1, 2]$, we conclude that

(a) $\dfrac{\pi}{4} + \dfrac{1}{5} < \tan^{-1} 2 < \dfrac{\pi}{4} + \dfrac{1}{2}$

(b) $\dfrac{\pi}{2} < \tan^{-1} 2 < \pi$

(c) $\dfrac{\pi}{8} < \tan^{-1} 2 < \dfrac{\pi}{4} + \dfrac{1}{5}$

(d) $\dfrac{1}{5} < \tan^{-1} 2 < \dfrac{1}{2}$

(e) $\dfrac{\pi}{4} + \dfrac{1}{2} < \tan^{-1} 2 < \dfrac{\pi}{2}$

23. The sum of two positive numbers is 5. If the product P of the square of the first number and the cube of the second number is **maximized**, then $P =$

(a) 25

(b) 72

(c) 64

(d) 108

(e) 16

24. If $\sinh x + \cosh x = 5$, then $\tanh x =$

(a) $\dfrac{13}{16}$

(b) $\dfrac{12}{13}$

(c) $\dfrac{1}{5}$

(d) $\dfrac{21}{25}$

(e) $\dfrac{3}{4}$

25. The **sum** of the critical numbrs of $f(x) = (x-1)^{3/5} \cdot (4-x)$ is

(a) $\dfrac{3}{7}$

(b) 0

(c) $\dfrac{25}{8}$

(d) $\dfrac{17}{8}$

(e) $-\dfrac{9}{8}$

26. $\displaystyle\lim_{x\to 0} \frac{x - \tan x}{x - \sin x} =$

(a) 1

(b) 0

(c) -2

(d) 2

(e) -1

27. Let a be a positive real number such that $a \neq e$. The **slope of the tangent line** to the curve $x^y = y^x$ at the point (a, a) is equal to

(a) $a \ln a$

(b) 1

(c) $\ln a - 1$

(d) a^2

(e) $-a$

28. If $f(x) = \dfrac{1}{2 + e^x}$, then $\displaystyle\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} =$

(a) $\dfrac{-2}{(2 + e^x)^2}$

(b) $\dfrac{-e^x}{(2 + e^x)^2}$

(c) e^{-x}

(d) $\dfrac{1}{3}$

(e) $2 + e^x$

Name ....

ID .... Sec ....

1	a	b	c	d	e	f
2	a	b	c	d	e	f
3	a	b	c	d	e	f
4	a	b	c	d	e	f
5	a	b	c	d	e	f
6	a	b	c	d	e	f
7	a	b	c	d	e	f
8	a	b	c	d	e	f
9	a	b	c	d	e	f
10	a	b	c	d	e	f
11	a	b	c	d	e	f
12	a	b	c	d	e	f
13	a	b	c	d	e	f
14	a	b	c	d	e	f
15	a	b	c	d	e	f
16	a	b	c	d	e	f
17	a	b	c	d	e	f
18	a	b	c	d	e	f
19	a	b	c	d	e	f
20	a	b	c	d	e	f
21	a	b	c	d	e	f
22	a	b	c	d	e	f
23	a	b	c	d	e	f
24	a	b	c	d	e	f
25	a	b	c	d	e	f
26	a	b	c	d	e	f
27	a	b	c	d	e	f
28	a	b	c	d	e	f
29	a	b	c	d	e	f
30	a	b	c	d	e	f
31	a	b	c	d	e	f
32	a	b	c	d	e	f
33	a	b	c	d	e	f
34	a	b	c	d	e	f
35	a	b	c	d	e	f

36	a	b	c	d	e	f
37	a	b	c	d	e	f
38	a	b	c	d	e	f
39	a	b	c	d	e	f
40	a	b	c	d	e	f
41	a	b	c	d	e	f
42	a	b	c	d	e	f
43	a	b	c	d	e	f
44	a	b	c	d	e	f
45	a	b	c	d	e	f
46	a	b	c	d	e	f
47	a	b	c	d	e	f
48	a	b	c	d	e	f
49	a	b	c	d	e	f
50	a	b	c	d	e	f
51	a	b	c	d	e	f
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53	a	b	c	d	e	f
54	a	b	c	d	e	f
55	a	b	c	d	e	f
56	a	b	c	d	e	f
57	a	b	c	d	e	f
58	a	b	c	d	e	f
59	a	b	c	d	e	f
60	a	b	c	d	e	f
61	a	b	c	d	e	f
62	a	b	c	d	e	f
63	a	b	c	d	e	f
64	a	b	c	d	e	f
65	a	b	c	d	e	f
66	a	b	c	d	e	f
67	a	b	c	d	e	f
68	a	b	c	d	e	f
69	a	b	c	d	e	f
70	a	b	c	d	e	f

Q	MM	V1	V2	V3	V4
1	a	d	d	d	c
2	a	a	b	a	d
3	a	d	d	c	d
4	a	b	b	a	a
5	a	d	a	b	a
6	a	a	a	c	d
7	a	b	b	e	c
8	a	b	e	c	c
9	a	b	e	c	c
10	a	b	c	b	b
11	a	a	a	b	e
12	a	b	a	a	b
13	a	d	d	b	a
14	a	b	b	e	c
15	a	a	e	c	b
16	a	a	b	e	e
17	a	c	e	e	a
18	a	d	a	e	e
19	a	c	a	a	b
20	a	b	c	a	e
21	a	c	b	b	c
22	a	b	e	d	a
23	a	a	a	c	d
24	a	e	b	c	b
25	a	a	c	b	c
26	a	a	e	b	c
27	a	b	a	c	b
28	a	e	d	b	b

Answer Counts

V	a	b	c	d	e
1	10	4	4	4	6
2	7	1	6	9	5
3	8	8	7	4	1
4	7	7	2	6	6