KING SAUD UNIVERSITY

COMMON FIRST YEAR

BASIC SCIENCES DEPARTMENT

Math 101 Final Exam 1439/1440 H.

First Semester

Time Allowed - 3 Hours

King Saud University

First Year Common

St. Name: _____ St. ID: _____ Section: _____

ملاحظات :

1- اكتب خطوات الحل بالتفصيل لجميع الأسئلة داخل دفتر الإجابة (الإجابة على ورقة الأسئلة غير معتمدة).

علمًا بأن عدد الأسئلة (٥)، وعدد الصفحات (٢).

2- لا يسمح بالكتابة إلا بالقلم الأزرق فقط.

3- لا يسمح بتدوال الآلة الحاسبة بين الطلاب.

4- لا يسمح باستخدام آلة حاسبة قابلة للبرمجة أو آلة حاسبة ترسم دوال.

Question 1: (13 Marks)

A) Solve the following inequality, and write your answer in an interval notation
$$2x - 4 \leq 6.$$

B) Use the definition of the limit to prove that $\lim_{x \to 2}(x + 4) = 6$.

C) Evaluate each of the following limits (if exist):

1) $\lim_{x \to 1}(3x + 5)$

2) $\lim_{x \to 0}\dfrac{\sin(4x)}{3x}$

3) $\lim_{x \to 5}\dfrac{x^2 - 8x + 15}{x - 5}$

4) $\lim_{x \to 2}\dfrac{x - 2}{\sqrt{x + 2} - 2}$

5) $\lim_{x \to 0} x^2 \cos\left(\dfrac{1}{x^2}\right)$

6) $\lim_{x \to \infty} \sin\left(\dfrac{\pi x + 2}{2x + 1}\right)$

Question 2: (6 Marks)

A) Prove that, if $f(x) = mx + c$ where m and c are real numbers, then

$f'(x) = m$.

B) Discuss the continuity of $f(x) = \begin{cases} \dfrac{x^2 - 4}{x - 2} & , \quad x \neq 2 \\ \\ -2 & , \quad x = 2 \end{cases}$ at $x = 2$.

C) The position of a particle is given by the equation $s(t) = 3t^3 + 2t^2 + 7$, where s in meters and t in seconds.

1- What is the velocity of the particle after 3 seconds?

2- What is the acceleration of the particle after 5 seconds?

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(9 Marks)

Find the derivative $\dfrac{d\,y}{d\,x}$ for each of the following:

A) $y = x^5 + x^3 + x^2 + 7$ B) $y = (x^2 + x)^{25}$

C) $y = \dfrac{\sin x}{x + 1}$ D) $y = x^2 \tan^{-1}(3x)$

E) $y = \cos^3 x^2 + \tan\left(\dfrac{\pi}{3}\right)$ F) $x^2 + y^2 = \sin(xy)$

Question 4:   (7 Marks)

A) Show that the function $f(x) = x^2 - 4x + 5$ satisfies the conditions of the mean value theorem on the interval $[0,2]$, then find the number c that satisfies the conclusion of the theorem.

B) Let $f(x) = x^2$. Find the absolute extrema of f in $[3,5]$.

C) What are the dimensions of a rectangle with perimeter equals $100\,cm$ which has maximum area?

D) Let $f(x) = \dfrac{x^2}{x^2 - 9}$. Find the vertical asymptote(s), if exist.

Question 5:   (5 Marks)

For the function $f(x) = x^4 - 4x^3 + 10$, find the following (if any):

A) The critical numbers of f.

B) The interval(s) on which f is increasing and decreasing.

C) The local extrema of f.

D) The interval(s) on which f is concave upward or downward.

E) Sketch the graph of f.

Good Luck

KING SAUD UNIVERSITY

COMMON FIRST YEAR

BASIC SCIENCES DEPARTMENT

Math 101 Final Exam alternative 1439/1440 H.

First Semester

Time Allowed - 3 Hours

St. Name: _____ St. ID: _____ Section: _____

ملاحظات :

1- اكتب خطوات الحل بالتفصيل لجميع الأسئلة داخل دفتر الإجابة (الإجابة على ورقة الأسئلة غير معتمدة).

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Question 1: (13 Marks)

A) Solve the following inequality, and write your answer in an interval notation
$$|3x + 2| > 9.$$

B) Use the definition of the limit to prove that $\lim_{x \to -3}(-x - 8) = -5$.

C) Evaluate each of the following limits (if exist):

1) $\lim_{x \to 4}\left(\dfrac{2x + 1}{2x}\right)$

2) $\lim_{x \to 0}\left(\dfrac{\sin(x)}{4x} + \dfrac{\sin(x)}{5}\right)$

3) $\lim_{x \to \infty} \tan\left(\dfrac{\pi x + 2}{x + 1}\right)$

4) $\lim_{x \to 0}\dfrac{1 - \cos^2 x}{2x^2}$

5) $\lim_{x \to 0}\dfrac{\sqrt{1 + x} - 1}{x}$

6) $\lim_{x \to 3}\dfrac{x^2 - 6x + 9}{x - 3}$

Question 2: (6 Marks)

A) Prove that, $\dfrac{d}{dx}\left(\cos^{-1} x\right) = -\dfrac{1}{\sqrt{1 - x^2}}$, $\quad -1 < x < 1$.

B) Discuss the continuity of $f(x) = \begin{cases} \dfrac{x^3 - 3x^2}{x - 3} & , \quad x < 3 \\ \\ 6 & , \quad x > 3 \end{cases}$ at $x = 3$.

C) The position of a particle is given by the equation $s(t) = 2t^3 - t^2 + 3$, where s in meters and t in seconds, what are the velocity and acceleration of the particle after 4 seconds?

1/2

Question 3: (9 Marks)

A- Find the derivative $\dfrac{dy}{dx}$ for each of the following:

A) $y = x^6 + x^5 + 2$

B) $y = x^4 \sin^{-1}(x^3) + \cos\left(\dfrac{\pi}{3}\right)$

C) $y = \left(\cos^2(x^5) + \sin^2(x^2)\right)^5$

D) $xy + y^2 = \sin(xy + 4)$

B- Suppose that f and g are differentiable functions at $x = 2$ and that
$$f(2) = -3, \ f'(2) = 5, \ g(2) = 1, \ and \ g'(2) = -4$$

Find $\dfrac{d}{dx}\left(\dfrac{x + g(x)}{x^2 - f(x)}\right)\Bigg|_{x=2}$.

Question 4: (7 Marks)

A) Show that the function $f(x) = x^3 - 3x^2 + x$ satisfies the conditions of the mean value theorem on the interval $[0,2]$, then find the number c that satisfies the conclusion of the theorem.

B) Let $f(x) = x^3$. Find the absolute extrema of f in $[-2, 4]$.

C) What are the dimensions of a rectangle with perimeter equals $120 \, cm$ which has maximum area?

D) Let $f(x) = \dfrac{x^2}{\sqrt{x^2 - 9}}$. Find the horizontal asymptote(s), if exist.

Question 5: (5 Marks)

For the function $f(x) = x^5 - 5x$, find the following (if any):

A) The critical numbers of f.

B) The interval(s) on which f is increasing and decreasing.

C) The local extrema of f.

D) The interval(s) on which f is concave upward or downward.

E) Sketch the graph of f.

Good Luck

KING SAUD UNIVERSITY

COMMON FIRST YEAR

BASIC SCIENCES DEPARTMENT

Math 101 Final Exam alternative 1439/1440 H.

First Semester

Time Allowed - 3 Hours

King Saud University

First Year Common

St. Name: _____

St. ID: _____

Section: _____

ملاحظات :

1- اكتب خطوات الحل بالتفصيل لجميع الأسئلة داخل دفتر الإجابة (الإجابة على ورقة الأسئلة غير معتمدة).

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Question 1:

(13 Marks)

A) Solve the following inequality, and write your answer in an interval notation
$$|3x + 2| > 9.$$

B) Use the definition of the limit to prove that $\lim\limits_{x \to -3}(-x - 8) = -5$.

C) Evaluate each of the following limits (if exist):

1) $\lim\limits_{x \to 4}\left(\dfrac{2x + 1}{2x}\right)$

2) $\lim\limits_{x \to 0}\left(\dfrac{\sin(x)}{4x} + \dfrac{\sin(x)}{5}\right)$

3) $\lim\limits_{x \to \infty} \tan\left(\dfrac{\pi x + 2}{x + 1}\right)$

4) $\lim\limits_{x \to 0}\dfrac{1 - \cos^2 x}{2x^2}$

5) $\lim\limits_{x \to 0}\dfrac{\sqrt{1 + x} - 1}{x}$

6) $\lim\limits_{x \to 3}\dfrac{x^2 - 6x + 9}{x - 3}$

Question 2:

(6 Marks)

A) Prove that, $\dfrac{d}{dx}\left(\cos^{-1} x\right) = -\dfrac{1}{\sqrt{1 - x^2}}, \quad -1 < x < 1$.

B) Discuss the continuity of $f(x) = \begin{cases} \dfrac{x^3 - 3x^2}{x - 3} &, \quad x < 3 \\ \\ 6 &, \quad x > 3 \end{cases}$ at $x = 3$.

C) The position of a particle is given by the equation $s(t) = 2t^3 - t^2 + 3$, where s in meters and t in seconds, what are the velocity and acceleration of the particle after 4 seconds?

Question 3: (9 Marks)

A- Find the derivative $\dfrac{dy}{dx}$ for each of the following:

A) $y = x^6 + x^5 + 2$

B) $y = x^4 \sin^{-1}(x^3) + \cos\left(\dfrac{\pi}{3}\right)$

C) $y = \left(\cos^2(x^5) + \sin^2(x^2)\right)^5$

D) $xy + y^2 = \sin(xy + 4)$

B- Suppose that f and g are differentiable functions at $x = 2$ and that
$$f(2) = -3, \ f'(2) = 5, \ g(2) = 1, \ and \ g'(2) = -4$$

Find $\dfrac{d}{dx}\left(\dfrac{x + g(x)}{x^2 - f(x)}\right)\Bigg|_{x=2}$.

Question 4: (7 Marks)

A) Show that the function $f(x) = x^3 - 3x^2 + x$ satisfies the conditions of the mean value theorem on the interval $[0,2]$, then find the number c that satisfies the conclusion of the theorem.

B) Let $f(x) = x^3$. Find the absolute extrema of f in $[-2,4]$.

C) What are the dimensions of a rectangle with perimeter equals $120\,cm$ which has maximum area?

D) Let $f(x) = \dfrac{x^2}{\sqrt{x^2 - 9}}$. Find the horizontal asymptote(s), if exist.

Question 5: (5 Marks)

For the function $f(x) = x^5 - 5x$, find the following (if any):

A) The critical numbers of f.

B) The interval(s) on which f is increasing and decreasing.

C) The local extrema of f.

D) The interval(s) on which f is concave upward or downward.

E) Sketch the graph of f.

Good Luck

2/2

KING SAUD UNIVERSITY

COMMON FIRST YEAR

BASIC SCIENCES DEPARTMENT

Math 101 Final Exam 1438/1439 H.

First Semester

Time Allowed - 3 Hours

St. Name: _____ St. ID: _____ Section: _____

ملاحظات :

1- اكتب خطوات الحل بالتفصيل لجميع الأسئلة داخل دفتر الإجابة **(الإجابة على ورقة الأسئلة غير معتمدة).**

علمًا بأن عدد الأسئلة (٦)، وعدد الصفحات (٢).

2- لا يسمح بالكتابة إلا بالقلم الأزرق فقط.

3- لا يسمح بتدوال الآلة الحاسبة بين الطلاب.

Question 1: (4 Marks)

A) Solve the following inequality, and write your answer in interval notation

$$|2x - 6| \leq 4$$

B) Use definition of limit to show that $\lim\limits_{x \to 1} (2x + 3) = 5$.

Question 2: (12 Marks)

Evaluate each of the following limits (if exist):

1) $\lim\limits_{x \to 1} (2x + 4)^2$

2) $\lim\limits_{x \to 2} \dfrac{x^2 + 3x - 10}{x - 2}$

3) $\lim\limits_{x \to 0} \dfrac{\sqrt{x + 9} - 3}{x}$.

4) $\lim\limits_{x \to 0} \dfrac{x^2 - 2x}{x}$

5) $\lim\limits_{x \to \infty} \left[1 + \cos\left(\dfrac{3}{2x + 1}\right)\right]$

6) $\lim\limits_{x \to 2} \dfrac{4x + 3}{x - 2}$

Question 3: (6 Marks)

A) Prove that if a function f is differentiable at a, then f is continuous at a.

B) Discuss the continuity of $f(x) = \begin{cases} x + 3 & , \quad x \leq 0 \\ \dfrac{\sin(6x)}{2x} & , \quad x > 0 \end{cases}$ at $x = 0$.

C) The position of a particle is given by the equation $s(t) = \dfrac{t - 1}{t + 1}$, where s is measured in meters and t in seconds. What is the acceleration of the particle after 3 seconds?

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Question 4:   (12 Marks)

Find the derivative $\dfrac{dy}{dx}$ for each of the following functions:

1) $y = \sin x + 2\cos x$

2) $y = \left(3x^2 + 5x + 2\right)^{30}$

3) $y = \sqrt{5x^2 + 7}$

4) $y = x^2 \tan(3x)$

5) $y = \tan^{-1}(4x)$

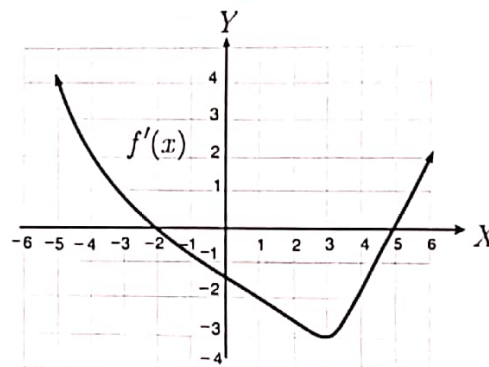6) $\dfrac{x^2 + y^2}{\sec x} = 1$

Question 5:   (6 Marks)

A) Given that $g(x) = 3x^2 + 5x + 1$, find the equation of the tangent line to the graph of $g(x)$ at $(1,9)$.

B) Show that the function $f(x) = x^2 + x$ satisfies the conditions of the Mean Value Theorem on $[-4,6]$. Then find a number c that satisfies the conclusion of the theorem.

C) The figure shows the graph of $f'(x)$. Determine the local minimum and local maximum of the function $f(x)$.

Question 6:   (10 Marks)

For the function $f(x) = x^4 - 4x^2$, find the following (if any):

1) The critical numbers of f.

2) The interval(s) on which f is increasing and decreasing.

3) The local extrema of f.

4) The interval(s) on which f is concave upward or downward.

5) Sketch the graph of f.

Good Luck

KING SAUD UNIVERSITY
COMMON FIRST YEAR
BASIC SCIENCES DEPARTMENT
Math 101 Mid term "Alternative" Exam 1438/1439 H.
Second Semester
Time Allowed - 2 Hours

First Year Common

St. Name: _____   St. ID: _____   Section: _____

ملاحظات :

1- اكتب خطوات الحل بالتفصيل لجميع الأسئلة داخل دفتر الإجابة (الإجابة على ورقة الأسئلة غير معتمدة).

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3- لا يسمح بتداول الآلة الحاسبة بين الطلاب.

4- لا تستخدم آلة حاسبة قابلة للبرمجة أو آلة حاسبة ترسم دوال.

Question 1: (5 Marks)

A) Determine algebraically whether the function $f(x) = \left| \dfrac{2x^4 + x^2}{\sin x} \right|$ is even, odd, or neither.

B) Solve $1 - 2\left|2x - 3\right| \geq -6$

Question 2: (6 Marks)

A) Let $f(x) = \dfrac{3}{\sqrt{x - 4}}$, $g(x) = x^2 + 4$. Find:

1) $(f \circ g)(x)$.

2) D_f, D_g, and $D_{f \circ g}$.

B) Show that $f(x) = x^2 - 4x - 5$, $x > 2$ is a one-to-one function.

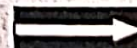C) Find the exact value of $\cos\left(2\cos^{-1}\left(\dfrac{4}{5}\right)\right)$, without using calculator.

Question 3: (4 Marks)

A) Use definition of limit to show that $\lim\limits_{x \to 0} (3x + 4) = 4$.

B) Use the Intermediate Value Theorem to show that $f(x) = x^2 - \dfrac{9}{x} + 1$ has a zero in the interval $[1, 3]$.

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Question 4: (9 Marks)

C) Evaluate each of the following limits (if exist):

1) $\lim\limits_{x \to 1} \dfrac{x^2 + 4}{2x + 2}$

2) $\lim\limits_{x \to 0} x^6 \sin\left(\dfrac{1}{x^2}\right)$

3) $\lim\limits_{x \to 3} \dfrac{\sqrt{x + 1} - 2}{x^2 - 9}$

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

5) $\lim\limits_{x \to \infty} \tan\left(\dfrac{\pi x - x}{x^2 + 5x}\right)$

6) $\lim\limits_{x \to \infty} \dfrac{x^2}{\sqrt{x - 1}}$

Question 5: (6 Marks)

A) Let $f(x) = 3x^2 - 2$, then use the definition of derivative to find $f'(x)$.

B) Find all vertical and horizontal asymptotes (if any) for $f(x) = \dfrac{2x - 5}{x + 3}$

C) Find the values of a and b such that the function $f(x) = \begin{cases} 2ax + 4b, & x > 1 \\ 3x + 2a, & x < 1 \\ 4, & x = 1 \end{cases}$

is continuous at every real number.

Good Luck

KING SAUD UNIVERSITY

COMMON FIRST YEAR

BASIC SCIENCES DEPARTMENT

Math 101 Final Exam 1438/1439 H.

Second Semester

Time Allowed - 3 Hours

St. Name: _____   St. ID: _____   Section: _____

ملاحظات :

1- اكتب خطوات الحل بالتفصيل لجميع الأسئلة داخل دفتر الإجابة (الإجابة على ورقة الأسئلة غير معتمدة).

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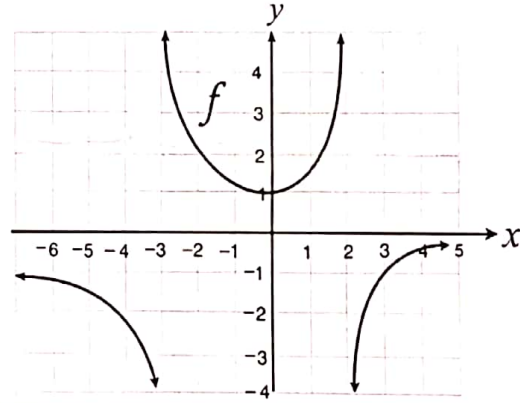
Question 1: (4 Marks)

A) Solve the following inequality, and write your answer in interval notation

$$|3x - 5| \geq 4$$

B) Use the graph of the function to determine the following (if exists):
1) The vertical asymptote(s).
2) The horizontal asymptote(s).

Question 2: (12 Marks)

Evaluate each of the following limits (if exist):

A) $\lim\limits_{x \to 2} \sqrt{2x + 5}$

B) $\lim\limits_{x \to 1} \dfrac{x^2 - x}{3 - 3x}$

C) $\lim\limits_{x \to 0} \dfrac{1 + \sin(3x) - \cos x}{6x}$

D) $\lim\limits_{x \to 3} \dfrac{\sqrt{x + 1} - 2}{x - 3}$

E) $\lim\limits_{x \to \infty} \cos\left(\dfrac{\pi x^2 + 2}{2x^2}\right)$

F) $\lim\limits_{x \to 2} \dfrac{|x - 2|}{x - 2}$

Question 3: (7Marks)

A) Prove that $\dfrac{d}{dx}\tan^{-1}x = \dfrac{1}{1+x^2}$.

B) Discuss the continuity of $f(x) = \begin{cases} \sin x & , \quad x \le 0 \\ x^2 - 1 & , \quad x > 0 \end{cases}$ at $x = 0$.

C) The position of a particle is given by the equation
$$s(t) = t^5 - 10t^2 + 1 ,$$
where s in meters and t in seconds. Find the velocity of the particle when its acceleration is zero.

Question 4: (12 Marks)

Find the derivative $\dfrac{dy}{dx}$ for each of the following:

A) $y = x^3 + \sin x + 4$

B) $y = x\sqrt[3]{(2x^2 - 5)^2}$

C) $y = \left(\cos^{-1} x\right)^4$

D) $y = \dfrac{x}{x+1}$

E) $y = 3\cos(\sin(2x))$

F) $x^2 + 3xy + y^2 = 2$

Question 5: (5 Marks)

A) Let $f(x) = 3x^4 - 2x + 2$, find the equation of the tangent line to the graph at $x = 1$.

B) If the function $f(x) = a\sqrt{x} + \dfrac{b}{\sqrt{x}}$ has a critical point at $(1,4)$, find the values of a and b.

Question 6: (10 Marks)

For the function $f(x) = x^3 - 3x + 2$, find the following (if any):

A) The critical numbers of f.

B) The interval(s) on which f is increasing and decreasing.

C) The local extrema of f.

D) The interval(s) on which f is concave upward or downward.

E) Sketch the graph of f.

Good Luck