Exam 2 version 2230 (1)

Wednesday, April 8, 2026 6:56 PM

Exam 2 version 2...

Test Number: 2230

MA 16010 **Exam 2** **Spring 2026**

Student's Name: Solutions **Section Number:** _____

(Without your name and section number, we will NOT be able to locate your exam booklet.)

1. Fill out your name and section number in the space provided above. On the scantron, fill in **your name, section number, test number and student ID**. Sign your name.
2. You can write on this exam booklet. Turn in both your scantron and your exam booklet when you are done. Note: **you will be graded ONLY based on your scantron answer sheet**.
3. Only a TI-30Xa calculator is allowed. No exceptions. No other electronic devices are allowed. No books or notes are allowed.
4. There are 12 questions with 8 points each for a total of 96 points. You will have 60 minutes to complete the exam. Good luck!

Instructor	Time	Section	Instructor	Time	Section
Chlopecki, Anna	2:30pm	104	Chlopecki, Anna	3:30pm	103
Cuadra, Alexandra	1:30pm	818			
Delgado, Huimei	9:30am	500	Delgado, Huimei	10:30am	100
Delworth, Tim	7:30am	200			
Makarova, Maiia	12:30pm	106	Makarova, Maiia	1:30pm	105
Singh, Mansimar	9:30am	107	Singh, Mansimar	10:30am	108
Wong Katherine	7:30am	110	Wong Katherine	8:30am	109

Problem 1

Find $g'(1)$ given $g(x) = \ln(x^4 + 3x^2 - 9)$.

1. (A) 10
   (B) -2
   (C) $-\frac{1}{5}$
   (D) 5
   (E) $-\frac{1}{2}$
   (F) 13

$$g'(x) = \frac{1}{x^4+3x^2-9} \frac{d}{dx}(x^4+3x^2-9)$$

$$= \frac{1}{x^4+3x^2-9}(4x^3+6x)$$

$$g'(1) = \frac{1}{1+3-9} \cdot (4+6) = \frac{10}{-5} = -2$$

Problem 2

Find $f'(4)$ if $f(x) = 3x^2\sqrt{x^2-7}$.

2. (A) 8
   (B) 32
   (B) 136
   (D) 4
   (E) 64
   (F) 80

$u(x) = 3x^2 \qquad v(x) = (x^2-7)^{1/2}$

$u'(x) = 6x \qquad v'(x) = \frac{1}{2}(x^2-7)^{-1/2}(2x)$

$$= \frac{x}{\sqrt{x^2-7}}$$

$$f'(x) = 3x^2\left(\frac{x}{\sqrt{x^2-7}}\right) + 6x\sqrt{x^2-7}$$

$$f'(4) = 3\cdot 4^2\left(\frac{4}{\sqrt{4^2-7}}\right) + 6\cdot 4\sqrt{4^2-7}$$

$\sqrt{4^2-7}$
$= \sqrt{16-7}$
$= \sqrt{9}$
$= 3$

$$= \cancel{3}\cdot 16\cdot\frac{4}{\cancel{3}} + 6\cdot 4\cdot 3$$

$$= 64 + 72 = 136$$

Problem 3

The position function of a particle moving in a straight line is given by $s(t) = 2t^3 - 9t^2 - 24t - 10$, where s is in meters and t is in seconds. Find the time when the particle's acceleration is 42 m/sec^2.

3. (A) 5 seconds
   (B) 6 seconds
   (C) 1 second
   (D) 4 seconds
   (E) 2 seconds
   (F) 3 seconds

$v(t) = s'(t) = 6t^2 - 18t - 24$

$a(t) = v'(t) = 12t - 18$

$a(t) = 12$

$12t - 18 = 42$

$12t = 60$

$t = 5$

Problem 4

Use implicit differentiation to find the equation of the tangent line to the graph of $x^2 + xy = 4 - y^2$ at $(-2,2)$.

4. (A) $y = -x + 4$
   (B) $y = -x$
   (C) $y = x + 4$
   (D) $y = x + 2$
   (E) $y = -x + 2$
   (F) $y = 2$

$2x\frac{dx}{dx} + 1 \cdot \frac{dx}{dx} \cdot y + x \cdot 1 \frac{dy}{dx} = 0 - 2y\frac{dy}{dx}$

$2x + y + x\frac{dy}{dx} = -2y\frac{dy}{dx}$

$2(-2) + 2 + (-2)\frac{dy}{dx} = -2(2)\frac{dy}{dx}$

$-4 + 2 - 2\frac{dy}{dx} = -4\frac{dy}{dx}$

$-2 = 2\frac{dy}{dx} - 4\frac{dy}{dx}$

$-2 = -2\frac{dy}{dx} \Rightarrow \frac{dy}{dx} = -1$

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

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

$y - 2 = -x - 2$

$y = -x$

Problem 5

The radius of a sphere changes at a rate of 2 inches per second. What is the rate of change of the surface area of the sphere, in in^2/sec, when the radius is 3 inches? The surface area of a sphere is given by the formula $S = 4\pi r^2$.

$\frac{dr}{dt} = 2$

$\frac{dS}{dt}\Big|_{r=3}$

$\frac{dS}{dt} = 4\pi \cdot 2r \frac{dr}{dt}$

$\frac{dS}{dt} = 8\pi \cdot 3 \cdot 2 = 48\pi$

5. (A) 24π
   (B) 72π
   (●) 48π
   (D) 16π
   (E) 36π
   (F) 108π

Problem 6

Which of the following is a critical number of $y = \frac{1}{5}x^5 + 2x^4$?

$y' = x^4 + 8x^3 = 0$

$x^3(x+8) = 0$

$x = 0, -8$

6. (A) 4
   (B) -1
   (●) -8
   (D) 8
   (E) -4
   (F) 1

Problem 7

$= 0 \Rightarrow x = -2, 3$

The function $f(x)$ is a polynomial and its derivative is $f'(x) = (x+2)(x-3)^2$. Choose the correct statement regarding the relative extrema.

$-$ U $+$ $+$

-3 0 4 f'

-2 3

7. (A) $f(x)$ only has a relative minimum at $x = -2$.

   (B) $f(x)$ only has a relative maximum at $x = -2$.

   (C) $f(x)$ only has a relative minimum at $x = 3$.

   (D) $f(x)$ has a relative minimum at $x = 3$ and a relative maximum at $x = -2$.

   (E) $f(x)$ only has a relative maximum at $x = 3$.

   (F) $f(x)$ has a relative minimum at $x = -2$ and a relative maximum at $x = 3$.

Problem 8

A plane flies due east at a speed of 390 miles per hour at an altitude of 5 miles. It passes directly over a radar station on the ground. How fast is the distance between the plane and the radar station changing after the plane has travelled 12 miles?

8. (A) 400 mi/h

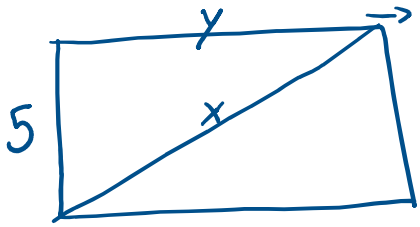
   (B) 402 mi/h

   (C) 375 mi/h

   (B) 360 mi/h

   (E) 423 mi/h

   (F) 395 mi/h



$\rightarrow$ 390 m/hr = dy/dt

$\left.\frac{dx}{dt}\right|_{y=12}$

$y^2 + 5^2 = x^2$

$2y\frac{dy}{dt} = 2x\frac{dx}{dt}$

$12(390) = x\frac{dx}{dt}$

$12(390) = 13\frac{dx}{dt}$

$\frac{12(390)}{13} = \frac{dx}{dt}$

30

When $y = 12$

$y^2 + 5^2 = x^2$

$12^2 + 5^2 = x^2$

$144 + 25 = x^2$

$169 = x^2$

$x = 13$

Problem 9

Find the largest interval on which the function $f(x) = xe^x$ is increasing.

9. (A) $(-\infty,-1)$

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

(C) $(-1,1)$

(D) $(1,\infty)$

(E) $(-\infty,\infty)$

(●) $(-1,\infty)$

$u(x) = x \qquad v(x) = e^x$

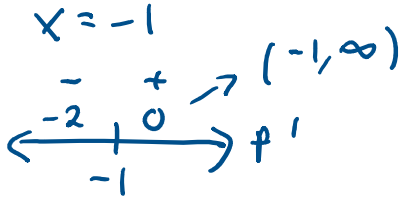
$u'(x) = 1 \qquad v'(x) = e^x$

$f'(x) = u'(x)v(x) + u(x)v'(x)$

$= 1 \cdot e^x + xe^x$

$= (x+1)e^x = 0$

$x = -1$



Problem 10

Find the x values at which the inflection points of $f(x) = \frac{1}{6}x^4 + x^3 - 10x^2 + 11$ occur.

10. (A) $x = 2$ and $x = 3$

(B) $x = 0$ and $x = 5$

(C) $x = 0$ and $x = 2$

(D) $x = 2$ and $x = 5$

(●) $x = -5$ and $x = 2$

(F) $x = -5$ and $x = -2$

$f'(x) = \frac{4}{6}x^3 + 3x^2 - 20x$

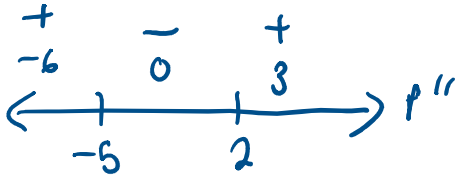
$f''(x) = \frac{4 \cdot 3}{6}x^2 + 6x - 20$

$= 2x^2 + 6x - 20 = 0$

$2(x^2 + 3x - 10) = 0$

$2(x+5)(x-2) = 0$

$x = -5, 2$



Problem 11

Consider the function

$$f(x) = x^3 + \frac{7}{2}x^2 + 2x - 9.$$

On which interval is the graph of $f(x)$ both decreasing and concave down?

11.
- (A) $(-\infty, -\frac{7}{6})$
- (B) $(-\infty, -2)$
- (C) $(-\frac{1}{3}, \infty)$
- $(-2, -\frac{7}{6})$
- (E) $(-2, -\frac{1}{3})$
- (F) $(-\frac{7}{6}, -\frac{1}{3})$

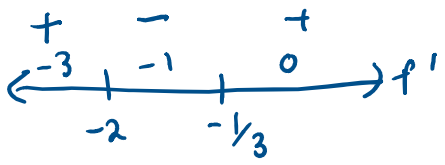
$f'(x) = 3x^2 + 7x + 2 = 0$

$3x^2 + 6x + x + 2 = 0$

$3x(x+2) + 1(x+2) = 0$

$(3x+1)(x+2) = 0$

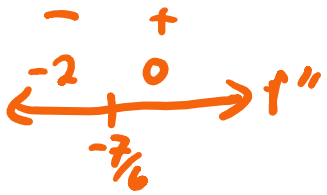
$x = -\frac{1}{3}, -2$



Dec. $(-2, -\frac{1}{3})$ ← overlap @ $(-2, -\frac{7}{6})$

$f''(x) = 6x + 7 = 0$

$x = -\frac{7}{6}$



Concave Down: $(-\infty, -\frac{7}{6})$

Problem 12

Choose the correct statement regarding the y values of the absolute maximum and the absolute minimum of $f(x) = x^3 - 3x + 10$ on the interval $[0,3]$.

12.
- (A) The y values of the absolute maximum and the absolute minimum are 28 and 10 respectively.
- (B) The y values of the absolute maximum and the absolute minimum are 12 and 8 respectively.
- (C) The y values of the absolute maximum and the absolute minimum are 28 and 12 respectively.
- (D) The y values of the absolute maximum and the absolute minimum are 12 and 10 respectively.
- (E) The y values of the absolute maximum and the absolute minimum are 12 and 28 respectively.
- The y values of the absolute maximum and the absolute minimum are 28 and 8 respectively.

$f'(x) = 3x^2 - 3 = 0$

$3(x^2 - 1) = 0$

$x = \pm 1$

But I want in $[0,3]$. So no $x = -1$

x	f(x)	
0	10	
1	1 − 3 + 10 = 8	min
3	27 − 9 + 10 = 28	max