Please mark your section number.

☐ Section L08  Slot 3,5T  M, W,F 10:30 & T 10:00 AM  W. Korytowski
☐ Section L09  Slot 2  M,W,F, 9:30 AM  T. Helms
☐ Section L10  Slot 4  T & Th, 8:30 AM  W. Korytowski
☐ Section L11  Slot 9  T & Th, 11:30 PM  A. Gerhard
☐ Section L12  Slot 9  T & Th, 11:30 PM  C.K. Gupta

INSTRUCTIONS TO STUDENTS:

This is a 1 hour exam. Please show your work clearly.

No calculators, texts, notes or other aids are permitted.

This exam has a title page, 6 pages of questions and 1 blank page at the end for rough work. Please check that you have all the pages.

The value of each question is indicated in the left-hand margin beside the statement of the question. The total value of all questions is 60.

Answer all questions on the exam paper in the space provide beneath the question. If you need more room, you may continue your work on the reverse side of the page, but CLEARLY INDICATE that your work is continued.

DO NOT WRITE IN THIS COLUMN

1. ________/10
2. ________/12
3. ________/8
4. ________/6
5. ________/9
6. ________/6
7. ________/9

TOTAL ________/60
Values

[10] 1. Find each limit, if it exists. If the limit does not exist, indicate whether it tends to $\infty$, $-\infty$, or neither.

(a) \[ \lim_{x \to \infty} \frac{(2x^3 + 2)(x^2 + 3x)}{4x^5 + 5} \]

(b) \[ \lim_{x \to -\infty} \frac{\sqrt{4x^2 + 7x + 2}}{3x + 5} \]

(c) \[ \lim_{x \to 0} \frac{\sqrt{x + 4} - 2}{x} \]
Values

[12] 2. In each case find the derivatives \( y \)! DO NOT SIMPLIFY your answers.

(a) \( y = x^\frac{1}{2} + x^\frac{3}{2} + x^\frac{5}{2} \)

(b) \( y = \frac{1 + \cos x}{1 + \sin x} \)

(c) \( y = \sin \left( e^{x^2} \right) \)
Values

[8] 3. Consider the function \( f(x) = \begin{cases} -3x & x < -1 \\ -3 & x = -1 \\ x^2 + 2 & x > -1 \end{cases} \)

You must use limits to justify your answers to the following.

(a) Does \( \lim_{x \to -1} f(x) \) exist, and if so what is its value?

(b) Is \( f(x) \) continuous at \( x = -1 \)?
Values

4. Prove the following theorem.

If \( f'(x) \) exists then \( (c \cdot f)(x) \) exists and \( (c \cdot f)'(x) = c(f'(x)) \).

5. Find the slope of the line tangent to the curve given by the equation

\[ x^2 y^2 - x^3 y^3 = 12 \]

at the point \((2, -1)\) on the curve.
6. Let \( f(x) = \sqrt{x+2} \). Find \( f'(x) \) directly from the definition of the derivative. Do not use any rules of differentiation.
Values

[9] 7. A police car is approaching an intersection going north and uses its radar to determine the speed of a truck which is leaving the intersection and speeding east. The reading is taken when the truck is 0.4 km from the intersection and the police car is 0.3 km from the intersection. At that instant the police car is traveling 90 km/hr. The radar indicates that the distance between the police car and the truck is increasing at 100 km/hr. How fast is the truck traveling at that instant?