

Name :

SS#

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Instructions: Do **ONLY** three of the following Calculus questions **AND** do **ONLY** two of the FORTRAN (CSCE 150) questions. Show your work and explain your answers. **Do not use calculators.**

Question 1: (20 points) Find the derivative of each of the following:

(a) $f(x) = 2x^4 + \frac{6}{x^3} + e^x$.

(b) $f(x) = \frac{6}{(x+2)^3}$.

(c) $f(x) = (x^2 + 5)^6$.

Question 2: (20 points) Find the following integrals:

(a) $\int (3x^2 + \frac{1}{x^3}) dx$.

(b) $\int \frac{1}{x+1} dx$.

(c) $\int (e^{3x} + 5) dx$

Question 3: (20 points)

(a) Find $\int_0^1 (x^2 + 5)dx$.

(b) If $f'(x) = 3x^2 + 6x$ and $f(1) = 2$, what is $f(x)$?

(c) Find the rate of change of $f(x) = e^{2x} + 5x$ at $x = 1$.

Question 4: (20 points)

(a) Let

$$G(x) = \begin{cases} x - 7 & \text{if } x > 3 \\ 5 - x & \text{if } x < 3 \\ \sqrt{555} & \text{if } x = 3 \end{cases}$$

Find the limit of $G(x)$ as $x \longrightarrow 3$.

(b) Let $f(x) = \frac{x^2 - 5x + 6}{x - 3}$. Find the limit of $f(x)$ as $x \longrightarrow 3$.

Question 5: (20 points) Let $f(x) = \frac{x^3}{3} - \frac{5x^2}{2} + 6x + 7$.

(a) Find the critical numbers of f .

- (b) Find the intervals on which f is increasing and the intervals on which f is decreasing.

In the following questions assume that the given programs have no syntax / run-time errors.

Question 6: (20 points) Find the value returned by $\text{MyFunc}(3)$, where MyFunc is given below.

```

:
FUNCTION MyFunc( $n$ )
    integer ::  $i$ ,  $P$ , MyFunc
    INTEGER, INTENT(IN) ::  $n$ 
     $P = 2$ 
    DO  $I=2$ ,  $2*n+1$ 
         $P = P * i$ 
    END DO
     $\text{MyFunc} = P$ 
END FUNCTION MyFunc

```

Question 7: (20 points) Find the value returned by $f(4, 2)$, where f is given below.

```

:
FUNCTION  $f(u, v)$ 
    INTEGER ::  $x$ ,  $t$ ,  $y$ ,  $f$ 
    INTEGER, INTENT(IN) ::  $u$ ,  $v$ 
     $x = u$ ;  $y = v$ 
    DO
        IF ( $y \leq 0$ ) EXIT
         $t = y$ 
         $y = x/y$ 
         $x = t$ 
    END DO
     $f = t$ 

```

END FUNCTION f

Question 8: (20 points) Find the value returned by $h(17)$, where h is given below.

:

```

FUNCTION h(x)
  REAL :: w, h
  REAL, INTENT(IN) :: x
  w = x/3
  if (w ≤ 5.5) then
    w = 5 * w
  ELSE
    w = 0
  END IF
  h = w
END FUNCTION h
}

```

Question 9: (20 points) Write a FORTRAN 90 function whose input is a positive integer n and whose output is the sum of the odd integers greater than or equal to 1 and less than or equal to n .

Hint: A positive integer k is odd if $MOD(k, 2) = 1$.