ABU DHABI POLYTECHNIC ACADEMIC SUPPORT DEPARTMENT

MATH 1010 – Calculus I

Make-up Final Exam
Sem.2 - 2024/2025
2 hours

Calculators are allowed
No additional materials are required

STUDENT NAME

STUDENT NUMBER

DEPARTMENT ASD

Please circle your CRN#:

Dr. Bassem: 4493, 4512, 4558, 4629 Dr. Georgios: 4275, 4380

Mr. Tinashe: 4336, 4433, 4591 Dr. Yasser: 4628

READ THESE INSTRUCTIONS CAREFULLY

Write your *name*, *number*, *CRN* and department **clearly** in the boxes above.

Answer **all** questions.

Show **all** your working and use appropriate **units.** Otherwise, you may lose marks.

You may use a pencil for all your work.

Answers that are not **clearly readable,** if any, will not be marked.

Part	Score
Part A.I	/20
Part A.II	/10
Part A.III	/6
Part B.I	/24
Part B.II	/12
Part B.III	/8
Total	/80

- **All mobile devices are not allowed during examination.**
- **Abu Dhabi Polytechnic considers cheating or attempting to cheat a serious offense that will result in disciplinary action taken against involved individuals.**

SHORT ANSWER. Write the result that best completes each statement (36 grades)

Part A.I: CLO 2,3 (20 grades)

Find the derivative of the function.

1) $f(x) = \dfrac{6x + 8}{7x - 6}$ 1) ______________

2) $y = \ln (7x^3 - x^2)$ 2) ______________

Find the derivative.

3) $f(x) = (3x^2 - 7)^3$ 3) ______________

Find the indicated higher derivative of the function.

4) $f'''(x)$ for $f(x) = 2x^3 + 2x^2 - 6x$ 4) ______________

Find an expression for the instantaneous acceleration of an object moving with rectilinear motion according to the given function. The instantaneous acceleration is defined as the instantaneous rate of change of the velocity with respect to time.

5) $s = 9t^2 + 5t - 9$ 5) ______________
[s is the displacement]

Solve the problem.

6) The size of a population after t months is $P = 100(1 + 0.2t + 0.02t^2)$. Find the growth rate after 10 months. 6) ______________

Find the derivative.

7) $y = 5 \sin (2x - 5)$ 7) ______________

8) $y = e^{7x^2} + x$ 8) ______________

9) $y = e^{\cos x}$ 9) ______________

Find the derivative of the function.

10) $y = \ln 6x^2$ 10) ______________

Part A.II: CLO 4,5 (10 grades)

Integrate the function.

11) $\displaystyle\int \frac{[\ln (4x + 3)]^2 \, dx}{4x+ 3}$ 11) ______________

12) $\displaystyle\int 4e^{-8x} \, dx$ 12) ______________

13) $\displaystyle\int x^5 e^{-x^6} \, dx$ 13) ______________

14) $\int \frac{\cos x \, dx}{1 + 9 \sin x}$ 14) ______________

Integrate the given expression.

15) $\int (2x + 4)^2 \, dx$ 15) ______________

Part A.III: CLO 1,6 (6 grades)

Solve the problem.

16) Suppose that an object's acceleration function is given by a = 4t + 7. The object's initial velocity (at t=0) is 3, and the initial position (at t=0) is 11. Find the object's displacement as a function of time. 16) ______________

Evaluate the limit by direct evaluation. Change the form of the function where necessary.

17) $\lim_{x \to 4} (x - 4)(\sqrt{x} - 2)$ 17) ______________

Use L'Hospital's rule to find the limit.

18) $\lim_{x \to \infty} \frac{9x}{e^{3x} + 1}$ 18) ______________

Part B.I: CLOs 2, 3 (24 grades)

Question 1 (6 grades)

Find the equation tangent line to the curve $y = \frac{9}{(x^2+1)^2}$ at the point$\left((1, \frac{9}{4}\right)$

Question 2 (6 grades)

Find the derivative of the given functions:

1) $f(x) = (1 - x^2)^3 e^{-x}$

2) $f(x) = \frac{\sin(2x)}{\cos(2x)}$

<u>Question 3 (4 grades)</u>

Find $\frac{dy}{dx}$ if $y^2 + 3xy = x^2 - 4$

<u>Question 4 (8 grades)</u>

For the function $y = f(x) = -x^3 + 3x^2 - 3$

1) find any relative maximum or minimum points of y.
2) find those values of x for which the function f is increasing and those values for which it is decreasing.

Part B.II: CLOs 4, 5 (12 grades)

Question 5 (8 grades)

Integrate:

1) $\int sin^3(2x)\, cos(2x)\, dx$

2) $\int 3x\, e^{x^2}\, dx$

Question 6 (4 grades)

Evaluate: $\int_a^b (x+1)(x-1)\ dx$

Part B.III: CLOs 6 (8 grades)

Question 7 (4 grades)

Find the area bounded by the curves: $y = 7 - 3x^2$ and $y = 4$

Question 8 (4 grades)

Suppose that the velocity is given by $v(t) = t^3 + 1$. Find the expression of displacement $s(t)$ as a function of time, if *s =5 m* when *t = 1 second.*

Calculus - I - Formulae

Derivatives	Integrals
$(u^n)' = nu^{n-1}u'$	$\int (du + dv) = u + v + c$
$(\sin u)' = u' \cos u$	$\int u^n du = \frac{u^{n+1}}{n+1} + c \quad (n \neq -1)$
$(\cos u)' = -u' \sin u$	$\int \frac{1}{u} du = \ln \lvert u \rvert + c$
$(\ln u)' = \frac{u'}{u}$	$\int \sin u \, du = -\cos u + c$
$(e^u)' = u'e^u$	$\int \cos u \, du = \sin u + c$
$(u \pm v)' = u' \pm v'$	$\int e^u \, du = e^u + c$
$(u \cdot v)' = u' \cdot v + u \cdot v'$	**Area under the curve** $= \int_a^b y \, dx$
$\left(\frac{u}{v}\right)' = \frac{u' \cdot v - u \cdot v'}{v^2}$	**Area between curves** $= \int_a^b (y_{\text{High}} - y_{\text{Low}}) \, dx$

- **The equation of the line passing through (x_1, y_1) and having a slope m is given by:**

$$y - y_1 = m(x - x_1)$$

- **Magnitude of the resultant of a vector V is given by:**

$$V = \sqrt{V_x^2 + V_y^2}$$

- **Reference angle of the resultant of vector V is given by:**

$$\theta_{\text{ref}} = \tan^{-1} \left| \frac{V_y}{V_x} \right|$$

Quadrant-specific Direction (θ):

$$\theta = \begin{cases} \theta_{\text{ref}} & \text{if Quadrant I } (V_x > 0, V_y > 0) \\ 180^\circ - \theta_{\text{ref}} & \text{if Quadrant II } (V_x < 0, V_y > 0) \\ 180^\circ + \theta_{\text{ref}} & \text{if Quadrant III } (V_x < 0, V_y < 0) \\ 360^\circ - \theta_{\text{ref}} & \text{if Quadrant IV } (V_x > 0, V_y < 0) \end{cases}$$