

King Saud University

Faculty of Sciences

Department of Mathematics

First Examination

Math 106

Semester I

1438-1439

Time: 1H30

**Exercise 1 :** (3+2+3)

a) Find the value of  $a$  so that  $\sum_{k=1}^{10} k^2 - ak = 0$ .

b) If  $F(x) = \cos(x^2) \int_0^{x^2} \cos^4(t) dt$ . Find  $F'(0)$ .

c) Use Simpson's rule with  $n = 4$  to approximate the integral  $\int_{-1}^1 \sqrt{1+x^4} dx$ .

**Exercise 2 :** (3+3+2)

a) Evaluate  $\int x^{\frac{1}{4}} (x^{\frac{5}{4}} - 4)^3 dx$ .

b) Compute the integral  $\int_1^e \frac{\sqrt[3]{1+\ln(x)}}{x} dx$ .

c) If  $y = x^{e^2}$ , find  $y'$ .

**Exercise 3 :** (3+3+3)

a) Evaluate the integral  $\int \frac{dx}{\csc(x) \sqrt{9 - \cos^2(x)}}$ .

b) Compute the integral  $\int \frac{dx}{\sqrt{e^{10x} - 25}}$ .

c) Find  $\int \frac{dx}{\sqrt{x}(x+16)}$ .

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Second Examination

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**Exercise 1 :** (3+2+3)

a) Find  $\lim_{x \rightarrow 0} (\cos x)^{\csc^2 x}$ .

b) Compute  $\int x \sec^2 x dx$ .

c) Evaluate  $\int \frac{dx}{x\sqrt{9-x^4}}$ .

**Exercise 2 :** (3+3+2)

a) Compute  $\int \sec^6 x \tan^4 x dx$ .

b) Find  $\int \frac{x^2}{(4-x^2)^{\frac{3}{2}}} dx$ .

c) Find  $\int \frac{dx}{\sqrt{x^2+4x+3}}$ .

**Exercise 3 :** (3+3+3)

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

b) Does the integral  $\int_0^{+\infty} e^{-\sqrt{x}} dx$  converge? Find its value if possible.

c) Find the area of the region bounded by  $y = x^2$ ,  $y = x + 2$ ,  $x = 0$ ,  $x = 3$ .

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Final Examination	Math 106	Semester I	1438-1439	Time: 3H
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Exercise 1 : (2+3)

a) If  $F(x) = \int_{2x}^{x^2} t \ln t dt$ ,  $x > 0$ , find  $F'(x)$ .

b) Approximate  $\int_0^5 \frac{dx}{\sqrt{1+x^4}}$  using the trapezoidal rule with  $n = 5$ .

Exercise 2 : (3+3+2)

a) Evaluate  $\int x 3^{2x^2} (3^{2x^2} + 1)^{-4} dx$ .

b) Find  $\int \frac{(\log_2 x)^2 + \sqrt{x}}{x} dx$ .

c) Compute  $\int \frac{dx}{\sqrt{e^{4x} - 36}}$ .

Exercise 3 : (3+3+3)

a) Find  $\int \ln(x^2 + 1) dx$ .

b) Evaluate  $\int \frac{dx}{x^3 \sqrt{x^2 - 1}}$ .

c) Compute  $f'(x)$  if  $f(x) = x^2(x^2 + 1)^{(x^3+1)}$ .

Exercise 4 : (3+3+3)

a) Find  $\int \frac{3x - 1}{x^2 + 4x + 8} dx$ .

- b) Find the area of the region bounded by the curves  $x = y^2$ ,  $x + y = 6$ ,  $y = -4$ ,  $y = 2$ .
- c) Set up integrals for the volume obtained by revolving the region bounded by  $y = 2x^2$ ,  $y = 8x$  about the lines
- (i)  $x = 5$ ,
  - (ii)  $y = -1$ .

**Exercise 5 :** (3+3+3)

- a) Find the area of the surface obtained by revolving the curve  $x = 2y^3$ ,  $0 \leq y \leq 1$ , about the  $y$ - axis .
- b) Find the area of the region inside the polar curve  $r = 1$  and outside  $r = 1 - \cos \theta$ .
- c) Compute the arc length of the curve  $r = 1 + \cos \theta$ .