

Course	Number	Section(s)	
Mathematics	209/4	All except EC	
Examination	Date	Time	Pages
Final	April 2015	3 Hours	2
Instructors	Course Examiner		
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Special Instructions:

- ▷ Answer all questions.
- ▷ Only approved calculators are allowed.

MARKS

[9] 1. Find the following limits:

(a) $\lim_{x \rightarrow 3^-} \frac{x-3}{|x-3|}$ (b) $\lim_{x \rightarrow 7} \frac{(x-7)^2}{x^2-4x-21}$ (c) $\lim_{x \rightarrow -\infty} \frac{2x^3}{3(x-2)^2}$

[18] 2. Find the derivative for each of the following (do not simplify):

(a) $y = x^{-\frac{1}{3}} - 3x^{-4}$

(b) $y = 9x^{\frac{1}{3}}(x^3 + 5)$

(c) $y = \frac{x^2 - 3x + 1}{x^2 - 1}$

(d) $y = (1 + e^x) \ln x$

(e) $y = \frac{2\sqrt{x}}{x^2 - 3x + 1}$

(f) $y = [\ln(x^2 + 3)]^{\frac{1}{2}}$

uv + vv'

$\frac{uv - vu'}{v^2}$

[6] 3. Use implicit differentiation to find $y' = \frac{dy}{dx}$ for $x \ln y + 2y = 2x^3$.

[6] 4. The average pulse rate y (in beats per minute) of a healthy person x inches tall is given approximately by

$$y = \frac{590}{\sqrt{x}} ; \quad 30 \leq x \leq 75$$

Approximately how will the pulse rate change for a change in height from 64 to 65 inches?

[12] 5. Given $f(x) = 2x^3 - 3x^2 - 36x$ find:

- (a) the critical value(s) of f .
- (b) the interval(s) where $f(x)$ is increasing;
- (c) the interval(s) where $f(x)$ is decreasing;
- (d) the local maxima and minima.

[6] 6. Given $g(x) = -x^4 + 12x^3 - 12x + 24$ find:

- (a) the interval(s) where $g(x)$ is concave upward;
- (b) the interval(s) where $g(x)$ is concave downward;
- (c) the inflection point(s);

[6] 7. Find the absolute extrema of $f(x) = x^4 - 4x^3 + 5$ on the interval $[-1, 2]$.

[9] 8. Evaluate the following; answers must be accurate to 3 decimals:

(a) $\int_{-1}^0 x^2(2+x^3)^{-2} dx$

(b) $\int_{-1}^1 \frac{e^{-x} - e^x}{(e^{-x} + e^x)^2} dx$

(c) $\int_0^5 \frac{x}{(x^2+10)} dx$

[10] 9. Compute the antiderivatives:

(a) $\int \frac{x}{\sqrt{x-3}} dx$

(b) $\int \frac{x^3}{\sqrt{2x^4+3}} dx$

(c) $\int 4x^2 \sqrt{x^3+5} dx$

(d) $\int \frac{e^x}{(e^x+2)^2} dx$

$2(17)y' = 4$
 $34y' = 4$
 $y' =$

[10] 10. Find the area bounded by $y = x^3 - 3x^2 - 9x + 12$ and $y = x + 12$.

[8] 11. A 17-foot ladder is placed against a wall. If the foot of the ladder is pushed toward the wall at 0.5 foot per second, how fast is the top of the ladder rising when the foot is 8 feet from the wall?

$x = 8 \quad y =$
 $x' = -0.5 \quad y' =$

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$x^2 + y^2 = 17^2$
 $2xx' + 2yy' = 0$
 $-4 + 2yy' = 0$

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