

Do not remove this answer page — you will turn in the entire exam. You have two hours to do this exam. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.

The exam consists of multiple choice questions. Record your answers on this page. For each multiple choice question, you will need to fill in the box corresponding to the correct answer. For example, if (b) is correct, you must write

☐ a ☒ b ☐ c ☐ d ☐ e

Do not circle answers on this page, but please circle the letter of each correct response in the body of the exam. It is your responsibility to make it CLEAR which response has been chosen. You will not get credit unless the correct answer has been marked on both this page and in the body of the exam.

GOOD LUCK!

1. ☒ a ☐ b ☐ c ☐ d ☐ e
2. ☐ a ☐ b ☐ c ☒ d ☐ e
3. ☐ a ☐ b ☒ c ☐ d ☐ e
4. ☒ a ☐ b ☐ c ☐ d ☐ e
5. ☐ a ☐ b ☐ c ☒ d ☐ e
6. ☐ a ☐ b ☐ c ☐ d ☒ e
7. ☐ a ☐ b ☒ c ☐ d ☐ e
8. ☒ a ☐ b ☐ c ☐ d ☐ e
9. ☐ a ☐ b ☐ c ☒ d ☐ e
10. ☐ a ☐ b ☐ c ☒ d ☐ e

11. ☐ a ☒ b ☐ c ☐ d ☐ e
12. ☐ a ☐ b ☐ c ☒ d ☐ e
13. ☒ a ☐ b ☐ c ☐ d ☐ e
14. ☒ a ☐ b ☐ c ☐ d ☐ e
15. ☐ a ☒ b ☐ c ☐ d ☐ e
16. ☐ a ☐ b ☒ c ☐ d ☐ e
17. ☐ a ☐ b ☒ c ☐ d ☐ e
18. ☐ a ☐ b ☐ c ☒ d ☐ e
19. ☒ a ☐ b ☐ c ☐ d ☐ e
20. ☐ a ☐ b ☐ c ☐ d ☒ e

For grading use:

Number Correct	
	(out of 20 problems)

Total	
	(out of 100 points)

Please make sure to list the correct section number on the front page of your exam. In case you forgot your section number, consult the following table. Your section number is determined by your recitation time and location.

Section #	Instructor	Lectures
001	L. Graham	T 8:00 am - 9:15 am, CB 243
002	X. Kong	T 9:30 am - 10:45 am, CP 208
003	X. Kong	T 11:00 am - 12:15 pm, CB 219
004	L. Graham	T 12:30 pm - 1:45 pm, DH 135
005	X. Kong	T 2:00 pm - 3:15 pm, DH 353
006	L. Graham	T 3:30 pm - 4:45 pm, CB 341
007	T. Kyriopoulos	R 8:00 am - 9:15 am, CB 243
008	N. Armenoff	R 9:30 am - 10:45 am, DH 323
009	N. Armenoff	R 11:00 am - 12:15 pm, L 213
010	T. Kyriopoulos	R 12:30 pm - 1:45 pm, CB 247
011	N. Armenoff	R 2:00 pm - 3:15 pm, DH 353
012	T. Kyriopoulos	R 3:30 pm - 4:45 pm, CB 341
013	C. Taylor	T 8:00 am - 9:15 am, CB 241
014	C. Taylor	T 9:30 am - 10:45 am, CB 338
015	J. Jung	T 11:00 am - 12:15 pm, CB 347
016	C. Taylor	T 12:30 pm - 1:45 pm, OHR 226
017	J. Jung	T 2:00 pm - 3:15 pm, CB 233
018	J. Jung	T 3:30 pm - 4:45 pm, CB 303
019	T. Brewer	R 8:00 am - 9:15 am, CB 341
020	R. May	R 9:30 am - 10:45 am, CP 208
021	T. Brewer	R 11:00 am - 12:15 pm, CB 219
022	T. Brewer	R 12:30 pm - 1:45 pm, DH 135
023	R. May	R 2:00 pm - 3:15 pm, CB 233
024	R. May	R 3:30 pm - 4:45 pm, CB 214

Multiple Choice Questions

*Show all your work on the page where the question appears.
Clearly mark your answer both on the cover page on this exam
and in the corresponding questions that follow.*

1. Find A if

$$6x^2 - 8x + 10 = A + B(x - 1) + C(x - 1)(x - 2).$$

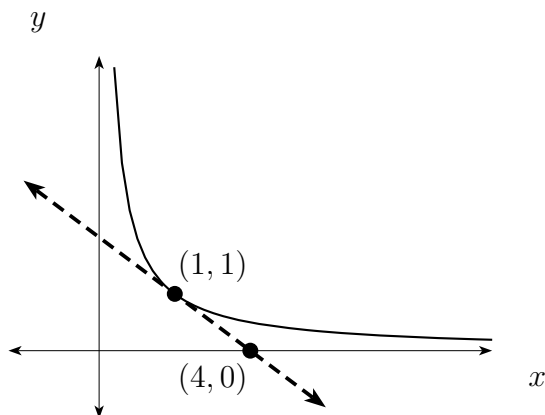
Possibilities:

- (a) 8
 - (b) 9
 - (c) 10
 - (d) 11
 - (e) 12
-

2. The graph of $y = g(x)$ is shown (solid), as well as the tangent line to the graph (dotted) at $x = 1$. Determine $g'(1)$.

Possibilities:

- (a) $1/4$
- (b) $-2/3$
- (c) 1
- (d) $-1/3$
- (e) 4



3. Compute

$$\lim_{t \rightarrow 0} \left(\frac{8}{t} + \frac{5t - 8}{t} \right)$$

Possibilities:

- (a) 3
 - (b) 4
 - (c) 5
 - (d) 6
 - (e) The limit does not exist.
-

4. Find the value of A which makes $f(x)$ continuous everywhere, where

$$f(x) = \begin{cases} 5x^2, & \text{if } x \leq -2; \\ -3x + A, & \text{if } x > -2 \end{cases}$$

Possibilities:

- (a) 14
- (b) 20
- (c) -6
- (d) -2
- (e) No such value of A exists

5. Suppose $g(3) = 4$ and $g'(3) = 2$. Find $F'(3)$, given that

$$F(x) = \frac{g(x)}{x}$$

Possibilities:

- (a) $\frac{1}{3}$
- (b) $\frac{2}{3}$
- (c) $\frac{-2}{3}$
- (d) $\frac{2}{9}$
- (e) $\frac{-2}{9}$

6. Determine the equation of the tangent line to $f(x) = 15 + 8 \ln(x)$ at $x = 1$.

Possibilities:

- (a) $y = 4(x - 1) + 19$
- (b) $y = 5(x - 1) + 18$
- (c) $y = 6(x - 1) + 17$
- (d) $y = 7(x - 1) + 16$
- (e) $y = 8(x - 1) + 15$

7. Find the derivative, $f'(x)$, where

$$f(x) = (4x^2 + 1)^{3/2}$$

Possibilities:

- (a) $6x \sqrt{4x^2 + 1}$
- (b) $(3/2) \sqrt{4x^2 + 1}$
- (c) $12x \sqrt{4x^2 + 1}$
- (d) $24 \sqrt{2x}$
- (e) $3 \sqrt{2x}$

8. Find the derivative, $s'(t)$, where

$$s(t) = e^{3t^2+4t}$$

Possibilities:

- (a) $(6t + 4) e^{3t^2+4t}$
- (b) $(3t^2 + 4t) e^{3t^2+4t}$
- (c) e^{6t+4}
- (d) $\ln(3t^2 + 4t)$
- (e) e^{3t^2+4t}

9. Boyle's Law states that when a sample gas is compressed at a constant temperature, the pressure P and volume V satisfy the equation $PV = c$, where c is a constant. Suppose that at a certain instant the volume is 32 cubic centimeters, the pressure is 4 kPa, and the pressure is increasing at a rate of 2 kPa/min. At what rate is the volume decreasing at this instant?

Possibilities:

- (a) 13 cubic centimeters per minute
 - (b) 14 cubic centimeters per minute
 - (c) 15 cubic centimeters per minute
 - (d) 16 cubic centimeters per minute
 - (e) 17 cubic centimeters per minute
-

10. Solving which inequality would help you determine where $y = f(x)$ is decreasing?

Possibilities:

- (a) $f(x) < 0$
- (b) $f'(x) > 0$
- (c) $f''(x) < 0$
- (d) $f'(x) < 0$
- (e) $f''(x) > 0$

11. Suppose $f(x) = x e^{-4x}$. Find the x -coordinate of the inflection point of $f(x)$
HINT: $f'(x) = (1 - 4x)e^{-4x}$ and $f''(x) = 4(4x - 2)e^{-4x}$.

Possibilities:

- (a) $x = -4$
- (b) $x = 1/2$
- (c) $x = -1/4$
- (d) $x = 1/4$
- (e) $x = -1/2$

12. Use the Fundamental Theorem of Calculus to compute the derivative of $F(x)$, if

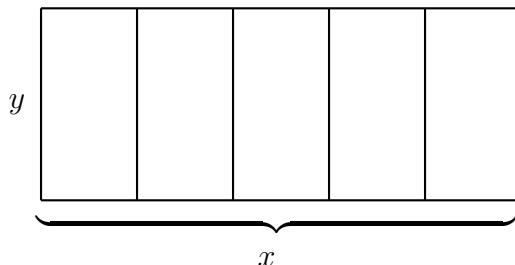
$$F(x) = \int_4^x \frac{10}{\sqrt{t^2 + 7}} dt$$

Your answer should be an expression involving the variable x .

Possibilities:

- (a) $\frac{20x}{(x^2 + 7)^{3/2}}$
- (b) 0
- (c) $\frac{10}{(x^2 + 7)^{3/2}}$
- (d) $\frac{10}{\sqrt{x^2 + 7}}$
- (e) $10\sqrt{(1/3)x^2 + 7}$

-
13. A rectangle is to be constructed with 5 vertical partitions (i.e., 6 vertical walls and 2 horizontal walls) as in the figure below. The rectangle is to be constructed with 600 feet of material. Let x denote the length of the horizontal wall and y the length of the vertical wall. Determine the dimensions that will enclose the largest area.



Possibilities:

- (a) $x = 150$ feet and $y = 50$ feet
- (b) $x = 150$ feet and $y = 60$ feet
- (c) $x = 75$ feet and $y = 75$ feet
- (d) $x = 150$ feet and $y = 150$ feet
- (e) None. It is possible to enclose an arbitrarily large area.

-
14. The integral

$$\int_6^9 x^3 dx$$

is computed as the limit of the sum

$$\sum_{k=1}^n \frac{3}{n} \left(A + k \frac{3}{n} \right)^3$$

What value of A must appear in the sum?

Possibilities:

- (a) 6
 - (b) 9
 - (c) 4
 - (d) 1
 - (e) 81
-

15. Compute

$$\lim_{n \rightarrow \infty} \frac{(3n - 7)^2}{8n^2 + 9n + 2}$$

If the limit tends to $\pm\infty$, select “Limit does not exist”.

Possibilities:

- (a) $1/8$
- (b) $9/8$
- (c) 0
- (d) $3/8$
- (e) Limit does not exist

16. Estimate the area under the graph of $f(x) = 4^x$ for x between 0 and 2. Use a partition that consists of 4 equal subintervals of $[0, 2]$ and use the left endpoint of each subinterval as the sample point.

Possibilities:

- (a) 2
- (b) 15
- (c) $15/2$
- (d) 5
- (e) 20

17. Evaluate the integral

$$\int_0^x \sqrt{t+4} \, dt$$

Possibilities:

- (a) $\frac{2}{3}(x+4)^{3/2}$
 - (b) $\frac{1}{2}(x+4)^{-1/2} - \frac{1}{8}$
 - (c) $\frac{2}{3}(x+4)^{3/2} - \frac{16}{3}$
 - (d) $\sqrt{x+4} - 2$
 - (e) $\frac{3}{2}(x+4)^{3/2} - 12$
-

18. Evaluate the integral

$$\int_3^5 \left(\frac{1}{t}\right)^2 dt$$

Possibilities:

- (a) $-1/15$
- (b) 0
- (c) $1/15$
- (d) $2/15$
- (e) $1/5$

19. Evaluate the integral

$$\int_0^x (t^3 + 3t^2 + t + 2) dt$$

Your answer should be an expression involving the variable x .

Possibilities:

- (a) $(1/4)x^4 + x^3 + (1/2)x^2 + 2x$
- (b) $(1/3)x^3 + (3/2)x^2 + x + 2$
- (c) $3x^2 + 6x + 1$
- (d) $(1/3)x^4 + x^3 + (1/2)x^2 + 2x$
- (e) $(1/4)x^3 + x^2 + (1/2)x + 2$

20. A train travels along a track and its speed (in miles per hour) is given by $s(t) = 40t$ for the first half hour of travel. Its speed is constant and equal to $s(t) = 20$ after the first half hour. (Here time t is measured in hours. How far (in miles) does the train travel in the first hour of travel?

Possibilities:

- (a) 40 miles.
 - (b) 10 miles.
 - (c) 20 miles.
 - (d) 5 miles.
 - (e) 15 miles.
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Some Formulas

1. Summation formulas:

$$\sum_{k=1}^n k = \frac{n(n+1)}{2}$$

$$\sum_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}$$

2. Areas:

(a) Triangle $A = \frac{bh}{2}$

(b) Circle $A = \pi r^2$

(c) Rectangle $A = lw$

(d) Trapezoid $A = \frac{b_1 + b_2}{2} h$

3. Volumes:

(a) Rectangular Solid $V = lwh$

(b) Sphere $V = \frac{4}{3}\pi r^3$

(c) Cylinder $V = \pi r^2 h$

(d) Cone $V = \frac{1}{3}\pi r^2 h$

4. Distance:

(a) Distance between (x_1, y_1) and (x_2, y_2)

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$