

Directions

1. Do NOT open this exam booklet until you are instructed to do so!
2. You may use a TI-84/85 (or equivalent) calculator. Any other electronic devices or outside materials are not permitted.
3. This exam is 8 pages (including this cover page) and has 9 questions. Check that you have every page of the exam before handing it in.
4. Please write your answers in the space provided. If you need more space, continue on the back of a page (being sure to clearly label your work). Do not write any answers on scrap paper.
5. Work must be clearly written and organized. Please organize your work and write legibly! Circle your final answers.
6. If you have a question, please raise your hand.

Good luck!

Do not write in the tables or on the line below.

Question	Points	Score
1	15	
2	5	
3	8	
4	12	
5	10	
6	10	
7	10	
8	20	
9	10	
Total:	100	

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1. (15 points) Find an equation for a line satisfying the following conditions.

(a) Through the point  $(2, 3)$  and parallel to  $y = 3x + 7$ .

(b) Through the point  $(-2, 6)$  and perpendicular to  $y = \frac{1}{3}x - 6$ .

(c) Through the points  $(4, 1)$  and  $(5, 3)$ .

2. (5 points) Determine the domain of the function  $f(x) = \frac{\ln(2-x)}{\sqrt{x+3}}$ .

3. (8 points) Solve for  $x$ .

(a)  $e^{3x+5} = 10$ .

(b)  $\log_2(x^2 - 3x) = 2$ .

4. (12 points) The number of bacteria in a culture is given by  $f(t) = 1200e^{kt}$ .

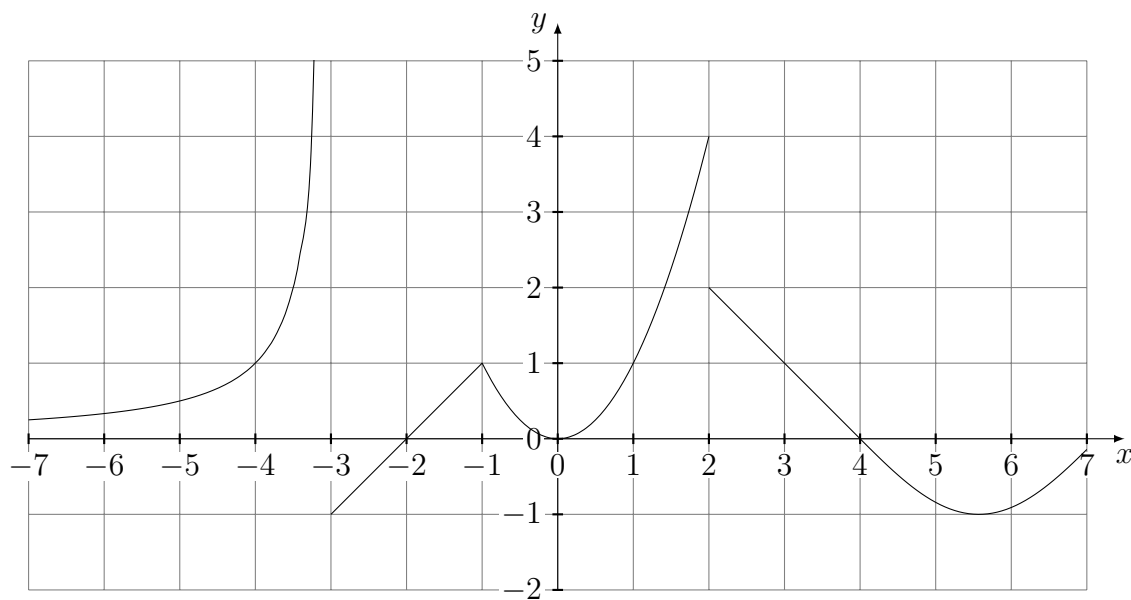
(a) Circle the correct answer. If  $k > 0$ , the number of bacteria will

- A. Keep growing forever      B. Die out

(b) If  $k = 0.2$ , at what time  $t$  will there be 3600 bacteria?

(c) If there are 200 bacteria after 3 hours, what is the decay constant  $k$ ?

The following is a graph of the function  $f(x)$  which will be used for problems 5, 6, and 7.



5. (10 points) Using the graph of  $f(x)$ , determine the following limits, if they exist.

(a)  $\lim_{x \rightarrow -3^+} f(x)$

(b)  $\lim_{x \rightarrow 0} f(x)$

(c)  $\lim_{x \rightarrow 2^-} f(x)$

(d)  $\lim_{x \rightarrow 2^+} f(x)$

(e)  $\lim_{x \rightarrow 2} f(x)$

6. (10 points) Is  $f(x)$  continuous or discontinuous at the following points. If  $f(x)$  is discontinuous, state why.

(a)  $x = -5$

(b)  $x = -3$

(c)  $x = -1$

(d)  $x = 2$

(e)  $x = 4$

7. (10 points) Is  $f(x)$  differentiable at the following points. If differentiable, estimate the derivative. If not differentiable, state why.

(a)  $x = -3$

(b)  $x = -2$

(c)  $x = -1$

(d)  $x = 0$

(e)  $x = 4$

8. (20 points) Find the following limits, if they exist.

(a)  $\lim_{x \rightarrow -2} \frac{x^2 + 3x + 2}{x + 2}$

(b)  $\lim_{x \rightarrow 0} \frac{\sqrt{2-x} - \sqrt{2}}{x}$

(c)  $\lim_{x \rightarrow -1} \frac{x^2 - 1}{x^2 + 2x + 1}$

(d)  $\lim_{x \rightarrow \infty} \frac{x^3 + 2x^2 + x}{3x^3 + 1}$

9. (10 points) Using the definition of the derivative, find the derivative of  $f(x) = 2x^2 + 3$ .