

Name:

ID:

## Discussion Section:

This exam has 20 multiple choice questions:

Important:

- No graphing calculators!
- Mark your answer on the answer card.
- You are allowed a  $4 \times 6$  note card for the exam.

1. Let  $f(x) = \sqrt{x}$  and  $g(x) = 1 - x^2$ . What is the domain of  $(f \circ g)(x)$ ?

- (a)  $(-\infty, \infty)$
- (b)  $(-\infty, -1] \cup [1, \infty)$
- (c)  $(-\infty, -1) \cup (1, \infty)$
- (d)  $[-1, 1]$
- (e)  $(-1, 1)$
- (f)  $[-1, \infty)$
- (g)  $[0, \infty)$
- (h)  $(0, \infty)$
- (i)  $[1, \infty)$

2. Which of the following best describes the function

$$f(x) \begin{cases} x + 1 & \text{if } x < 0; \\ e^x & \text{if } x \geq 0 \end{cases}$$

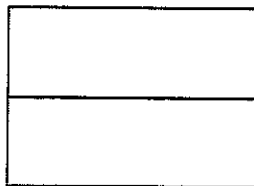
near  $x = 0$ ?

- (a) Doesn't have a limit as  $x \rightarrow 0$
- (b) Has a limit as  $x \rightarrow 0$ , but not continuous
- (c) Continuous, but not differentiable
- (d) Differentiable, but not continuous
- (e) Continuous and differentiable
- (f) Asymptote

3. Find the limit:

$$\lim_{x \rightarrow 1} \frac{\sqrt{x} - 1}{x - 1}$$

- (a) -1
  - (b) -1/2
  - (c) -1/3
  - (d) 0
  - (e) 1/3
  - (f) 1/2
  - (g) 3/4
  - (h) 1
  - (i) DNE
4. A gardener wants to fence in a rectangular area and then divide the area in half with a fence down the middle parallel to one side (see the diagram below). If the gardener has 60m of fencing material, what is the largest possible area (in  $\text{m}^2$ ) of the total fenced-in region?



- (a) 60
- (b) 120
- (c) 150
- (d) 180
- (e) 225
- (f) 240
- (g) 250
- (h) 300
- (i) 500
- (j) 900

5. Let  $f(x) = \sin x + \cos x$ . Find the absolute minimum and maximum values of  $f(x)$  on the interval  $[0, \pi]$ .
- (a) Minimum:  $-2$ ; Maximum:  $2$
  - (b) Minimum:  $-\sqrt{2}$ ; Maximum:  $\sqrt{2}$
  - (c) Minimum:  $-1$ ; Maximum:  $1$
  - (d) Minimum:  $-1$ ; Maximum:  $\sqrt{2}$
  - (e) Minimum:  $-1$ ; Maximum:  $\sqrt{2}/2$
  - (f) Minimum:  $-1$ ; Maximum:  $0$
  - (g) Minimum:  $-\sqrt{2}/2$ ; Maximum:  $\sqrt{2}/2$
  - (h) Minimum:  $0$ ; Maximum:  $1$
  - (i) Minimum:  $0$ ; Maximum:  $\sqrt{2}$
  - (j) Minimum:  $0$ ; Maximum:  $\sqrt{2}/2$
6. A rock is thrown into a pond and causes a circular ripple. If the radius of the ripple is increasing at a rate of 4 feet per second, how fast (in square feet per second) is the area changing when the radius is 10 feet?
- (a)  $4\pi$
  - (b)  $8\pi$
  - (c)  $10\pi$
  - (d)  $16\pi$
  - (e)  $40\pi$
  - (f)  $80\pi$
  - (g)  $100\pi$
  - (h)  $200\pi$
  - (i)  $400\pi$
  - (j)  $800\pi$
7. The graph of  $y = \frac{4x^2+2x+1}{x+2}$  has a slant asymptote. What is the equation of the asymptote?
- (a)  $y = x - 3$
  - (b)  $y = x + 1$
  - (c)  $y = 2x - 6$
  - (d)  $y = 2x - 1$
  - (e)  $y = 2x + 4$
  - (f)  $y = 4x - 6$
  - (g)  $y = 4x - 1$
  - (h)  $y = 4x + 2$
  - (i)  $y = 6x$

8. Which of the following best describes the graph of  $y = x \ln x$  when  $x = 1/e$ ?
- (a) increasing, concave down
  - (b) increasing, concave up
  - (c) decreasing, concave down
  - (d) decreasing, concave up
  - (e) local maximum
  - (f) local minimum
  - (g) critical point, inflection point
  - (h) increasing, inflection point
  - (i) decreasing, inflection point
  - (j) not differentiable at this point
9. The demand function for mePods is  $p = 200 - x$ , where  $p$  is the price (in dollars) at which  $x$  mePods can be sold. The cost (in dollars) of producing  $x$  mePods is  $C(x) = 100 + 20x + 2x^2$ . How many mePods should be produced in order to maximize profit?
- (a) 20
  - (b) 25
  - (c) 30
  - (d) 35
  - (e) 40
  - (f) 45
  - (g) 50
  - (h) 55
  - (i) 60
10. Find the slope of the graph of  $2x^2 + y^2 = 3xy$  at the point  $(1, 2)$ .
- (a)  $-1/2$
  - (b)  $-1/4$
  - (c) 0
  - (d)  $2/5$
  - (e)  $3/8$
  - (f)  $1/4$
  - (g)  $1/2$
  - (h) 1
  - (i) 2
  - (j)  $5/2$

11. The half-life of a certain radioactive element is 100 days. How many days will it take for a 100mg sample to decay to 10mg? Choose the closest answer.

- (a) 100
- (b) 200
- (c) 240
- (d) 270
- (e) 300
- (f) 330
- (g) 370
- (h) 400
- (i) 420
- (j) 1000

12. Find the slope of the graph of  $y = x^{1/x}$  when  $x = 2$ . Choose the closest answer.

- (a) 0
- (b) 0.1
- (c) 0.2
- (d) 0.3
- (e) 0.4
- (f) 0.5
- (g) 0.6
- (h) 0.8
- (i) 1
- (j) 1.2

13. Find the area enclosed by the parabolas  $y = x^2$  and  $y = 8 - x^2$ .

- (a) 0
- (b)  $1/3$
- (c) 1
- (d)  $4/3$
- (e)  $8/3$
- (f) 16
- (g)  $32/3$
- (h)  $64/3$
- (i) 32

14. Suppose that the demand equation for corn is  $p = 200 - x$ , where  $p$  is the price (in dollars per ton) at which  $x$  tons of corn are demanded. Suppose that the supply equation is  $p = x^2/100$ . If corn is being sold at the equilibrium price, what is the total economic surplus in the corn market? Choose the closest answer.
- (a) \$1,667
  - (b) \$3,333
  - (c) \$5,000
  - (d) \$6,667
  - (e) \$8,333
  - (f) \$10,000
  - (g) \$11,667
  - (h) \$13,333
  - (i) \$15,000
  - (j) \$20,000
15. Suppose money is contributed to a retirement account at an annual rate of \$5,000. If the rate of return for the investment is 10% compounded continuously, approximately how much will the account be worth after 20 years?
- (a) \$100,000
  - (b) \$178,000
  - (c) \$233,000
  - (d) \$289,500
  - (e) \$319,500
  - (f) \$362,000
  - (g) \$419,500
  - (h) \$504,000
  - (i) \$739,000

16. What is

$$\int_0^2 \sqrt{4-x^2} dx ?$$

Choose the closest answer.

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) 5
- (f) 6
- (g) 7
- (h) 8
- (i) 9

17. What is the area below the graph of  $y = \sin x$  between  $x = 0$  and  $x = \pi$ ?

- (a) 0
- (b)  $\sqrt{2}/2$
- (c)  $\sqrt{3}/2$
- (d) 1
- (e)  $\sqrt{2}$
- (f)  $\pi/2$
- (g)  $\sqrt{3}$
- (h) 2
- (i)  $\pi$

18. Compute

$$\int_1^2 \frac{x^2 + 1}{x} dx.$$

Choose the closest answer,

- (a) 1
- (b) 1.19
- (c) 1.38
- (d) 2.19
- (e) 2.5
- (f) 2.65
- (g) 2.78
- (h) 3.14
- (i) 3.33
- (j) 3.69

19. Use a Riemann sum with  $n = 4$  and left endpoints to estimate the area under the graph of  $f(x) = e^{-x^2}$  between  $x = 0$  and  $x = 1$ . Choose the closest answer.
- (a) 0.82
  - (b) 0.99
  - (c) 1.18
  - (d) 1.35
  - (e) 1.51
  - (f) 1.68
  - (g) 1.77
  - (h) 2.13
  - (i) 3.29
20. Find the function  $f(x)$  for which  $f'(x) = \sqrt{x}$  and  $f(1) = 1$ . What is  $f(4)$ ?
- (a)  $1/4$
  - (b)  $3/8$
  - (c) 1
  - (d)  $17/16$
  - (e)  $4/3$
  - (f) 2
  - (g)  $5/2$
  - (h) 4
  - (i)  $17/3$