(a) 
$$(-1,-1+\frac{3\pi}{2})$$
,  $(0,0)$ 

(c) 
$$(2\pi, 2\pi), (\pi, \pi)$$

(d) 
$$(\pi,\pi)$$
,  $(0,0)$ 

2. Find all open intervals on which the function  $f(x) = \frac{x}{x^2 + x - 2}$  is decreasing

(a) 
$$(-\infty, \infty)$$

(b) 
$$(-\infty, 0)$$

(c) 
$$(-\infty, -2)$$
 and  $(1, \infty)$ 

(a) 
$$(-\infty, \infty)$$
 (b)  $(-\infty, 0)$   
(d)  $(-\infty, -2)$ ,  $(-2, 1)$  and  $(1, \infty)$ 

3. A farmer has 160 feet of fencing to enclose 2 adjacent rectangular pig pens. What dimensions should be used so that the enclosed area will be a maximum?

(a) 
$$4\sqrt{15}$$
 ft by  $\frac{8}{5}\sqrt{15}$  ft (b) 40 ft by  $\frac{80}{3}$  ft (c) 20 ft by  $\frac{80}{3}$  ft

(b) 40 ft by 
$$\frac{80}{3}$$
 f

(c) 20 ft by 
$$\frac{80}{3}$$
 ft

4. Given that  $f(x) = -x^2 + 12x - 28$  has a relative maximum at x = 6, choose the correct statement

(a) 
$$f$$
 is negative on the interval  $(-\infty, 6)$  (b)  $f$  is positive on the interval  $(-\infty, \infty)$ 

(b) 
$$f$$
 is positive on the interval  $(-\infty, \infty)$ 

(c) 
$$f$$
, is negative on the interval  $(6, \infty)$ 

(c) f is negative on the interval 
$$(6, \infty)$$
 (d) f is positive on the interval  $(6, \infty)$ 

5. Find the point on the graph of  $y = \sqrt{x+1}$  closest to the point (3,0)

(b) 
$$\left(\frac{5}{2}, \sqrt{\frac{7}{2}}\right)$$
 (c)  $(3, 2)$  (d)  $(2, \sqrt{3})$ 

(d) 
$$(2, \sqrt{3})$$

(e) none of these

6. Given the function  $f(x) = e^{\frac{1}{2}}$  on the closed interval [-1, 4], if c is the number guaranteed by the mean value theorem, then c (correct to three decimal places) is approximately

- (a) 0.998
- (b) 1.163
- (c) 1.996
- (d) 2.065
- (e) 2.325

7. A particle moves in a straight line such that its distance at time t from a fixed point on the line is given by  $8t - 3t^2$  units. What is the total distance covered by the particle from t = 1 to t = 2?

(b) 
$$\frac{4}{3}$$
 units

(b) 
$$\frac{4}{3}$$
 units (c)  $\frac{5}{3}$  units

## Multiple Choice (non-calculator section)

1. Find all critical numbers for the function  $f(x) = (9 - x^2)^{\frac{3}{5}}$ 

- (a) 0
- (b) 3
- (c) -3, 3 (d) -3, 0, 3

(e) none of these

2. Find the values of x that give relative extrema for the function  $f(x) = (x+1)^2(x-2)$ 

- (a) rel. max: x = -1; rel. min: x = 1 (b) rel. max x = 1, x = 3; rel. min x = -1
- (c) rel. min x = 2 (d) rel. max x = -1; rel. min x = 2

(e) none of these

3. Let  $f''(x) = 3x^2 - 4$  and let f(x) have critical numbers -2, 0, and 2. Use the Second Derivative Test to determine which critical numbers, if any, gives a relative minimum

- (a) -2
- (b) 2
- (c) 0
- (d) -2 and 2

(e) none of these

4. Find all points of inflection:  $f(x) = \frac{1}{12}x^4 - 2x^2 + 15$ 

- (a) (2,0)

- (b) (2,0), (-2,0) (c) (0,15) (d)  $(2,\frac{25}{3})$ ,  $(-2,\frac{25}{3})$

(e) none of these

5. State why Rolle's Theorem does not apply to the function  $f(x) = \frac{2}{(x+1)^2}$  on the interval [-2,0]

- (a) f is not continuous on [-2,0]
  - (b)  $f(-2) \neq f(0)$
- (c) f is not differentiable at x = -1
- (d) Both a and c

(e) none of these

6. Let f(x) be a polynomial function such that f(-2) = 5,  $f^{-1}(-2) = 0$ , and  $f^{-1}(-2) = 3$ . The point (-2, 5) is a\_\_\_\_\_ \_\_\_\_\_of the graph of f

- (a) relative maximum
- (b) relative minimum
- (c) intercept

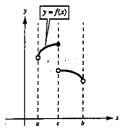
- (d) point of inflection
- (e) none of these

7. If  $V = \frac{4}{3}\pi r^3$ , what is  $\frac{dV}{dr}$  when r = 3?

- (a)  $4\pi$
- (b)  $12\pi$
- (c)  $24\pi$
- (d)  $36\pi$
- (e)  $42\pi$

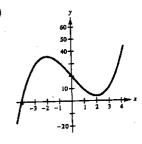
8. Determine from the graph whether f possesses extrema on the interval (a, b).

- (a) Maximum at x = c, minimum at x = b
- (b) Maximum at x = c, no minimum
- (c) No maximum, minimum at x = b
- (d) No extrema
- (e) None of these

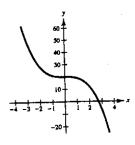


9. Which of the following is the correct sketch of the graph of the function  $y = x^3 - 12x + 20$ ?

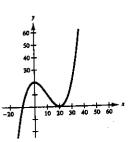
(a)



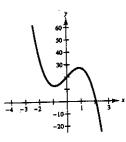
(b)



(c)

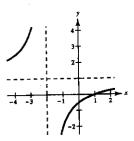


(d)

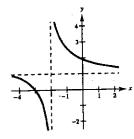


- (e) None of these
- 10. Which of the following is the correct sketch of the graph of the function  $f(x) = \frac{x-1}{x+2}$ ?

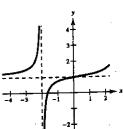
(a)



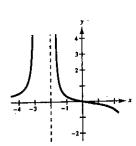
(b)



(c)

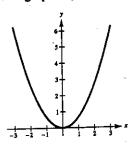


(d)

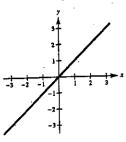


- (e) None of these
- 11. The figure given in the graph is the second derivative of a polynomial function, f. Choose a graph of f.

(a)

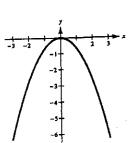


(b)



3+ 2+ -3 -2 -1 1 2 3 x

(c)



(d)

