1. Which of the following are critical points of the function $f(x) = 1 - (x-1)^{2/3}$?

A) 0

B) 1

C) 5/4

D) 7/3

E) $\sqrt{2}$

F) $\sqrt{3}$

G) π

H) 2π

I) 3π

J) None of the above

2. The continuous function $f(x) = x^3 - 12x^2 + 21x$ attains a maximum value on the closed interval $[0, 2]$. At which x does this occur?

A) 0

B) 1

C) 5/4

D) 7/3

E) $\sqrt{2}$

F) $\sqrt{3}$

G) π

H) 2π

I) 3π

J) None of the above

3. Find the maximum value taken on by $f(x) = \sin x \cos x$ on the interval $[\,0, \pi/2]$.

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

4. Consider the function $f(x) = e^x - x$ on the interval [-1, 1]. Find a point c in the interval which satisfies the conclusion of the mean value theorem for this f(x) and [a, b]. c =

A) 0

B) .0082

C) .0132

D) .1126

E) .1375

F) .1614

G) .1853

H) .2054

I) .2709

J) None of the above

5. The finction $f(x) = 3x^5 - 5x^3$ is decreasing on an interval [-1, a] and then is increasing on [a, ∞]. Find a.

A) 0

B) 1

C) 5/4

D) 7/3

E) $\sqrt{2}$

F) $\sqrt{3}$

G) π

H) 2π

I) 3π

J) None of the above

6. $f(x) = x^{5/3}$ changes concavity at only one point a. Find a.

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

7. the function $f(x) = \dfrac{1}{x^2+1}$ has a single point of inflection in the interval $(0, \infty)$. Find it.

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

8. the function $f(x) = e^{-x^2}$ has a single point of inflection in the interval $(0, \infty)$. Find it.

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

9. Find any points x at which the function $f(x) = \dfrac{x^2}{x^2 - 5x + 6}$ has a vertical asymptote.

A) 1

B) 2

C) 3

D) -2

E) -3

F) 2 and 3

G) 1 and 2

H) -1 and 3

I) -2 and -3

J) None of the above

10. Find any lines y = b which are horizontal asymptotes of $f(x) = \frac{x^2}{x^2 - 5x + 6}$. b =

A) 0

B) 1

C) 5/4

D) 7/3

E) $\sqrt{2}$

F) $\sqrt{3}$

G) π

H) 2π

I) 3π

J) None of the above

11. Find the x – coordinate of the point on the curve $y = \sqrt{x}$ which is closest to the point $(1, 0)$.

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

12. A box will be constructed from two kinds of sheet metal. The metal for the top and bottom, which are to be square, costs \$1 per m^2. The metal for the sides costs \$2 per m^2. *To the nearest dollar,* what is the material cost for the cheapest such box whose volume is 20 m^3 ?

A) 16

B) 43

C) 70

D) 124

E) 467

F) 1085

G) 5238

H) 11664

I) 15893

J) None of the above

13. What is the maximum possible area of a right triangle the length of whose legs add up to 2?

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

14. According to U. S. Postal regulations, a rectangular box is "oversized" if the sum of its height and its girth (perimeter of the base) exceeds 108 inches. Find the maximum volume (in cubic inches) that a box can have if 1) it has a square base, and 2) it is *not* oversized.

A) 16

B) 43

C) 70

D) 124

E) 467

F) 1085

G) 5238

H) 11664

I) 15893

J) None of the above

15. Evaluate $\lim_{x\to 0^+}\left(\frac{1}{\sin x}-\frac{1}{x}\right)$.

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

16. Find $\lim_{x\to 1} \dfrac{\tan^{-1} x - \pi/4}{\tan\left(\frac{\pi}{4}x\right) - 1}$.

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

17. Suppose Newton's method is used to approximate a root of $x^4 + x^2 - 2x - 1 = 0$. The initial guess is $x_o = 1$. Find the next approximation x_1.

A) 0

B) 1

C) 5/4

D) 7/3

E) $\sqrt{2}$

F) $\sqrt{3}$

G) π

H) 2π

I) 3π

J) None of the above

18. Evaluate $\lim_{x\to\infty} \frac{3x^6+4x^2-7}{9x^6+12x^4+2x}$.

A) 0

B) 1/3

C) 1/2

D) $1/\sqrt{2}$

E) $1/\sqrt{3}$

F) $1/\pi$

G) $1/2\pi$

H) $\pi/3\sqrt{2}$

I) $\pi/2\sqrt{3}$

J) None of the above

19. Let y(t) be the solution to the initial value problem $\frac{dy}{dt} = 5 - 2t^2$, $y(1) = \frac{20}{3}$. Find y(0).

A) 0

B) 1

C) 5/4

D) 7/3

E) $\sqrt{2}$

F) $\sqrt{3}$

G) π

H) 2π

I) 3π

J) None of the above

20. Let y(x) be the solution of $\frac{dy}{dx} = \sec^2 3x, \quad y\left(\frac{\pi}{4}\right) = 2$. Find y(0).

A) 0

B) 1

C) 5/4

D) 7/3

E) $\sqrt{2}$

F) $\sqrt{3}$

G) π

H) 2π

I) 3π

J) None of the above