1. The domain of the function $\sqrt{1-|x-5|}$ is

A. $[-1,5]$

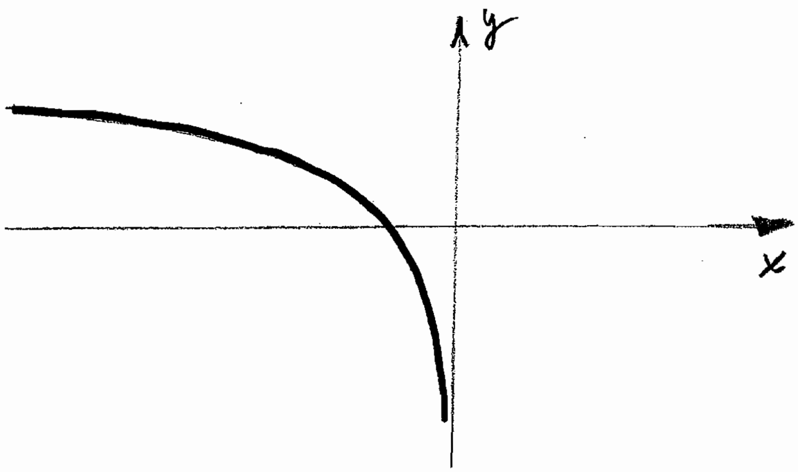
B. $(3,6)$

C. $(-5,1)$

D. $[2,4]$

E. $[4,6]$

2. Which function is graphed below?



A. $\ln(-x)$

B. $-\ln x$

C. e^{-x}

D. $-e^{-x}$

E. $-e^{x}$

3. One of the following is INCORRECT. Which one? For positive numbers x, y

A. $e^{x+y} = e^x e^y$

B. $(e^x)^y = e^{xy}$

C. $\sqrt{x+y} = \sqrt{x} + \sqrt{y}$

D. $\sqrt{xy} = \sqrt{x}\sqrt{y}$

E. $\ln(x^y) = y \ln x$

4. Suppose that $f(x)+g(x) = h(x)$, $\lim_{x\to 2} g(x) = 3$ and $\lim_{x\to 2} h(x) = -1$. If f is continuous, then $f(2)$ must be

A. 2

B. -2

C. 4

D. -4

E. There is not enough information to tell for sure

5. The horizontal asymptote(s) of the function $F(x) = e^{-e^x}$ is (are)

A. $y = e$

B. $y = 0$ and $y = 1$

C. $y = 0$ and $y = 1/e$

D. $y = e^{-e}$

E. There is no horizontal asymptote.

6. Consider the secant line of the curve $y = x^2$ through the points where $x = 2$ and where $x = 4$. The slope of this secant is

A. 4

B. 8

C. 3

D. 6

E. 18

7. If $\varphi(t) = \sqrt{t}e^t$ then $\varphi'(1) =$

A. 1

B. $2e$

C. $3e/2$

D. $1/(2\sqrt{e})$

E. 0

8. In the atmosphere a spherical shock wave, caused by a sonic boom, is traveling outwards at $1/3$ km/s. At what rate, in km^2/s, does the area occupied by the shock wave increase, 9 seconds after the boom? (The area of a sphere of radius r is $4\pi r^2$.)

A. 36π

B. 18π

C. 8π

D. 24π

E. 16π

9. When $x = -\frac{\pi}{6}$, $\frac{d}{dx} 3^{\sin x} =$

A. $\ln 3$

B. $\frac{\sqrt{3}}{2}$

C. $\ln \sqrt{3}$

D. 3

E. $\sqrt{3}$

10. The slope of the tangent line to the curve $e^x + \cos \pi x + e^y + \cos \pi y = e + 1$ at $(1, 0)$ is

A. π

B. $-\pi$

C. πe

D. e

E. $-e$

11. A radioactive substance has a half–life of 50 days. Initially a sample contains 15 mg. After how many days will only 2 mg remain?

A. $50 \ln \dfrac{15}{2}$

B. $50 \dfrac{\ln 15}{\ln 2}$

C. $50 \dfrac{\ln(2/15)}{\ln(1/2)}$

D. $\dfrac{\ln 2}{50 \ln(2/15)}$

E. $\dfrac{\ln(15/2)}{50}$

12. A particle moves along the graph of $y = x^2 + x$. When the particle is at the point $(1, 2)$, the x coordinate is increasing at 3 units per second. At that moment, how fast is the distance from the particle to the point $(-1, 0)$ changing?

A. $6\sqrt{2}$

B. $\sqrt{2} + \sqrt{6}$

C. 12

D. $\sqrt{12}$

E. 3

13. If f is a differentiable function on $(-\infty, \infty)$, $f(2) = 4$, and $f(6) = 8$, which of the following statements must be true?

I. There is a c in $(2, 6)$ such that $f(c) = 6$.

II. There is a c in $(2, 6)$ such that $f'(c) = 6$.

III. There is a c in $(2, 6)$ such that $f'(c) = 1$.

A. Only I

B. Only II

C. Only I and II

D. Only I and III

E. Only II and III

14. The absolute maximum and absolute minimum of $g(x) = x^2 - 2x^4$ on $[-1, 1]$ are

A. 1 and 0

B. 1 and -1

C. $1/8$ and 0

D. $1/4$ and -1

E. $1/8$ and -1

15. $\lim_{x\to 0} \dfrac{\cos(2x) - \cos(3x)}{x^2} =$

A. $5/2$

B. $-1/2$

C. $13/2$

D. 1

E. 0

16. A farmer with N ft of fencing wants to enclose a rectangular region and then divide it into 3 pens with fencing parallel to one side of the rectangle. What is the largest possible total area of the 3 pens in ft^2?

A. $N^2/9$

B. $N^2/32$

C. $N^2/20$

D. $N^2/8$

E. $N^2/16$

17. Suppose F is a continuous function on $(-\infty, \infty)$. If it has a local extremum at c, which of the following must be true?

I. $F'(c) = 0$.

II. $F'(c) = 0$ or F is not differentiable at c.

III. $F''(c) \neq 0$.

A. Only I

B. Only II

C. Only III

D. Only I and II

E. Only II and III

18. $\frac{d}{dx} \int_1^{x^2} \frac{dt}{1+t^2} =$

A. $-\ln(1+x^2) + \ln 2$

B. $1/(1+x^2)$

C. $x^2/(1+x^2)$

D. $2x/(1+x^4)$

E. $4x^3/(1+x^2)$

19. $\displaystyle\int_{-1}^{0} \frac{dx}{(x-1)^3} =$

A. $-5/8$

B. $-3/8$

C. $-45/16$

D. $-1/2$

E. $1/2$

20. $\displaystyle\int_{0}^{\pi/2} \cos 3t dt =$

A. $-1/2$

B. 1

C. 0

D. $1/3$

E. $-1/3$

21. If $h''(x) = e^x(x-1)^3(x+2)$, find all open intervals where h is concave down.

A. $(0,1)$

B. $(-\infty,0)$ and $(1,\infty)$

C. $(-2,0)$ and $(0,1)$

D. $(-2,1)$

E. $(-\infty,-2)$ and $(1,\infty)$

22. Find all open intervals where $\varphi(x) = \dfrac{3+x^2}{2-x^2}$ is increasing.

A. $(-\infty,0)$

B. $(-\infty,-\sqrt{2})$ and $(-\sqrt{2},0)$

C. $(-\sqrt{2},\sqrt{2})$

D. $(0,\sqrt{2})$ and $(\sqrt{2},\infty)$

E. $(0,\infty)$

23. If $f''(x) = 6x + 2$, $f(1) = 2$ and $f'(1) = 4$ then $f(3) =$

A. 18

B. 30

C. 34

D. 8

E. 22

24. If $\int_2^4 g(t)dt = 2$ and $\int_2^5 g(t)dt = 6$, then $\int_4^5 g(t)dt =$

A. -4

B. 4

C. -8

D. 8

E. 12

25. $\int_0^1 x\sqrt{1+3x^2}\,dx =$

A. 2

B. 2/3

C. 1/3

D. 7/9

E. 5/6