

1. $\lim_{x \rightarrow 2^-} \frac{x^2 - x + 5}{x - 2} =$

- a) 0
- b) 7
- c) ∞
- d) $-\infty$
- e) $-\frac{5}{2}$

2. $\lim_{x \rightarrow 25} \frac{\sqrt{x} - 5}{x - 25} =$

- a) $\frac{1}{10}$
- b) $\frac{1}{5}$
- c) 1
- d) 0
- e) ∞

3. $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sin x - \cos x}{\tan x - 1} =$

- a) 0
- b) 1
- c) $\frac{\sqrt{2}}{2}$
- d) -1
- e) The limit does not exist

4. $\lim_{x \rightarrow 1^-} \frac{2x(1-x)}{|x-1|} =$

- a) $-\infty$
- b) -2
- c) 0
- d) 2
- e) ∞

5. If $f(x) = \begin{cases} x^2 + 3, & x < 1 \\ 10 - x, & 1 \leq x \leq 2 \\ 6x - x^2, & x > 2 \end{cases}$, which one of the following statements is true?

- a) f is continuous on its domain.
- b) f has a jump discontinuity at $x = 1$ and a removable discontinuity at $x = 2$.
- c) f has only one discontinuity, a jump discontinuity at $x = 1$.
- d) f has jump discontinuities at $x = 1$ and $x = 2$.
- e) f has only one discontinuity, a removable discontinuity at $x = 2$.

6. For what value of c is the function f continuous on $(-\infty, \infty)$?

$$f(x) = \begin{cases} \frac{\sin(cx)}{3x} & \text{if } x < 0 \\ cx + 1 & \text{if } x \geq 0 \end{cases}$$

- a) 1
- b) 0
- c) $\frac{1}{3}$
- d) 6
- e) 3

7. Determine $\lim_{h \rightarrow 0} \frac{\cos(\frac{\pi}{3} + h) - \cos(\frac{\pi}{3})}{h}$.

- a) $-\frac{1}{2}$
- b) $\frac{1}{2}$
- c) $-\frac{\sqrt{3}}{2}$
- d) $\frac{\sqrt{3}}{2}$
- e) 0

8. For what value(s) of x does the graph of $y = 2x^3 - 3x^2 - 12x + 20$ have tangent line(s) parallel to the line $y = \sqrt{2} - 12x$?

- a) $x = 0, x = 1$
- b) $x = 2, x = -1$
- c) $x = 0$ only
- d) $x = 2, x = 1$
- e) $x = -1$ only

9. Find the slope of the curve $y = \sin x \cdot \cos x$ at the point $\left(\frac{\pi}{4}, \frac{1}{2}\right)$
- $-\frac{\sqrt{2}}{2}$
 - 0
 - $\frac{\sqrt{2}}{2}$
 - 1
 - $\frac{1}{2}$
10. If $y = \sqrt{\frac{z+1}{z-1}}$ find y' .
- 0
 - $\frac{\sqrt{z-1}}{2\sqrt{z+1}}$
 - $\frac{-1}{\sqrt{z+1}(z-1)^{\frac{3}{2}}}$
 - $\frac{-2z\sqrt{z+1}}{(z-1)}$
 - $\frac{-2}{\sqrt{z+1}}$
11. $f(x) = \sin \sqrt{1+x^2}$, find $f'(x)$.
- $\frac{x \cos \sqrt{1+x^2}}{\sqrt{1+x^2}}$
 - $2x \cos \sqrt{1+x^2}$
 - $\frac{\cos \sqrt{1+x^2}}{2\sqrt{1+x^2}}$
 - $\frac{x \cos \sqrt{1+x^2}}{4\sqrt{1+x^2}}$
 - $\frac{x \cos \sqrt{1+x^2}}{\sqrt{1+x^2}}$
12. Find an equation of the line tangent to the curve $x^2 + 4xy + y^2 = 13$ at the point $(2, 1)$.
- $y = \frac{5}{4}x + \frac{7}{2}$
 - $y = \frac{5}{4}x - \frac{3}{2}$
 - $y = \frac{2}{3}x - \frac{1}{3}$
 - $y = -\frac{2}{5}x + \frac{9}{5}$
 - $y = -\frac{4}{5}x + \frac{13}{5}$
13. If a ball is thrown vertically upward with a velocity of 80 ft/sec, then its height s after t seconds is $s = 80t - 16t^2$ ft. What is the maximum height reached by the ball?
- 64 ft
 - 80 ft
 - 96 ft
 - 100 ft
 - 200 ft
14. A spy tracks a rocket launched vertically from a launch pad 10 km away. At a certain moment, the spy's instruments show that the angle of elevation θ to the rocket is $\frac{\pi}{3}$ radians and is changing at a rate of .5 rad/s. Find the rocket's velocity at that moment.
- $10\sqrt{3}$ km/s
 - 20 km/mins
 - $\frac{5}{4}$ km/s
 - 15 km/s
 - 10 km/s
- Questions 15-19 are true/false type. **Mark A for true, B for false.** Each true/false question is worth 2 points.
15. If the left- and right- hand limits of $f(x)$ as $x \rightarrow a$ exist and are equal, then $f(x)$ is continuous at $x = a$.
- True
 - False
16. If f is differentiable at $x = 2$, then $f'(2)$ is the slope of the tangent line to the curve of $y = f(x)$ at the point $(2, f(2))$.
- True
 - False
17. If f is differentiable at a , then $\lim_{x \rightarrow a} f(x)$ exists.
- True
 - False

18. If $y = f(x)g(x)$, then $\frac{d^2y}{dx^2} = f(x)g''(x) + g(x)f''(x)$.

- a) True
- b) False

15. 20. (10 pts.)

a) State the limit definition of the derivative, $f'(x)$.

19. If $\lim_{x \rightarrow c} f(x) = L$ then $f(c) = L$.

- a) True
- b) False

b) Use the definition stated in part a) above to find the derivative of $f(x) = \sqrt{x-2}$.

16. 21. (10 pts.) A water tank has the shape of an inverted circular cone with base radius 4 m and height 6 m. If water is being pumped into the tank at a rate of $16 \text{ m}^3/\text{min}$, find the rate at which the water level is rising when the water is 3 m deep.

(Volume of a cone, $V = \frac{1}{3}\pi r^2 h$)

- a) a) True
- b) b) False

MATH 140 EX1 FA07

ITEM NO. FORM: A

1	D
2	A
3	C
4	D
5	C
6	E
7	C
8	A
9	B
10	C
11	AE
12	E
13	D
14	B
15	B
16	A
17	A
18	B
19	B

20. $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

Answer: $\frac{1}{2\sqrt{x-2}}$ use defn above

21. $\frac{4}{\pi}$ m/min