1. If $f(x) = \dfrac{2 - \frac{1}{x}}{x - 3}$, then $f'(2) =$

   (a) $-\dfrac{7}{4}$ _____(correct)

   (b) $-\dfrac{3}{2}$

   (c) $\dfrac{5}{4}$

   (d) $-2$

   (e) $\dfrac{3}{2}$

2. The slope of the tangent line to the curve $y = \dfrac{1 + \sec x}{1 - \sec x}$ at the point $\left(\dfrac{\pi}{3}, -3\right)$ is equal to

   (a) $4\sqrt{3}$ _____(correct)

   (b) $-8$

   (c) $-4\sqrt{3}$

   (d) $8$

   (e) $-\sqrt{3}$

3. The derivative of $y = \dfrac{e^x}{2}(\cos x + \sin x)$ is

(a) $e^x \cos x$ _____(correct)

(b) $e^x \sin x$

(c) $\dfrac{e^x}{2}(\cos x + \sin x)$

(d) $\dfrac{e^x}{2}(-\sin x + \cos x)$

(e) 0

4. If $g(x) = \ln\left(\dfrac{3x^2 - 2}{2x + 3}\right)^{-2}$, then $g'(-1) =$

(a) 16 _____(correct)

(b) $-8$

(c) 8

(d) $-16$

(e) $-4$

5. The slope of the normal line to the curve $\sin(\pi xy) = \ln x$ at the point $(1, 0)$ is equal to

(a) $-\pi$ (correct)

(b) $-\dfrac{1}{\pi e}$

(c) $-2\pi$

(d) $-\dfrac{1}{2\pi}$

(e) $-\dfrac{e}{\pi}$

6. If $x > 0$, $y > 0$ and $y = x^{xy}$, then $\dfrac{dy}{dx} =$

(a) $\dfrac{y^2(1+\ln x)}{1-xy\ln x}$ (correct)

(b) $\dfrac{y^2(1-\ln x)}{1+xy\ln x}$

(c) $\dfrac{y^2(1+2\ln x)}{1-2xy\ln x}$

(d) $\dfrac{y^2(1+x\ln x)}{1-y\ln x}$

(e) $\dfrac{y(1+\ln x)}{1-xy^2\ln x}$

7. If $x + y - 1 = \ln(x^2 + y^2)$, then $\dfrac{d^2y}{dx^2}$ at the point $(1, 0)$ is equal to

(a) 0 _____(correct)

(b) 1

(c) $-1$

(d) $-2$

(e) 2

8. If $f(x) = \dfrac{x+6}{x-2}$ and $x > 2$, then $(f^{-1})'(3) =$

(a) $-2$ _____(correct)

(b) 2

(c) $-4$

(d) 4

(e) 6

9. The equation of the tangent line to the curve $\arctan(xy) = \arcsin(x+y)$ at $(0,0)$ is

(a) $y = -x$ _____(correct)

(b) $y = x$

(c) $y = 2x$

(d) $y = \frac{\pi}{4}x$

(e) $y = \pi x$

10. The voltage $V$ in volts of an electrical circuit is $V = IR$, where $R$ is the resistance in ohms and $I$ is the current in amperes. $R$ is increasing at a rate of 2 ohms per second, and $V$ is increasing at a rate of 8 volts per second. At what rate is $I$ changing when $V = 10$ volts and $R = 5$ ohms?

(a) 4/5 amperes per second _____(correct)

(b) 3/5 amperes per second

(c) 2/5 amperes per second

(d) 1/5 amperes per second

(e) 8/5 amperes per second

11. An airplane is flying at an altitude of 6 kilometers on a flight path that will take it directly over a radar tracking station. If the distance $S$ between the airplane and the radar station is decreasing at a rate of 400 kilometers per hour when $S = 10$ kilometers, then the speed of the plane is

(a) 500 km/h (correct)
(b) $-600$ km/h
(c) 450 km/h
(d) 550 km/h
(e) $-550$ km/h

12. Using Newton's Method if the initial guess to approximate the zero of $f(x) = 2x^2 - 1$ is $x_1 = \frac{1}{2}$, then $x_3 =$

(a) $\frac{17}{24}$ (correct)
(b) $\frac{11}{16}$
(c) $\frac{13}{21}$
(d) $\frac{5}{8}$
(e) $\frac{19}{24}$

13. The sum of the extreme values of the function $f(x) = 1 + 4x - 6x^{2/3}$ on the interval $[-1, 1]$ is equal to

(a) $-8$ _____(correct)

(b) $-9$

(c) $-7$

(d) $0$

(e) $-10$

14. If $f(x) = 2\sin x - \cos 2x$, then the absolute maximum of $f$ over the interval $[0, 2\pi]$ is equal to

(a) $3$ _____(correct)

(b) $-1$

(c) $\frac{3}{2}$

(d) $-\frac{3}{2}$

(e) $6$

15. The value of $c$ in the interval $(1, 9)$ that satisfies the conclusion of the Mean Value Theorem for $f(x) = \sqrt{x}$ is

(a) 4 _____(correct)

(b) 3

(c) 2

(d) 5

(e) 6

16. If the graph of $f(x) = x^2 - x - 2$ intersects the $x$-axis at $a$ and $b$ where $a < b$ and if $c$ is the value between $a$ and $b$ that satisfies Rolle's Theorem, then $a + b + c =$

(a) $\frac{3}{2}$ _____(correct)

(b) 1

(c) $\frac{1}{2}$

(d) $\frac{5}{2}$

(e) 2

17. If $(a, b)$ is a point on the graph of $f(x) = \dfrac{x+1}{x-1}$ at which the tangent line is parallel to the line $2y + x = 6$, then $a + b =$

(a) $-1$ or $5$ (correct)

(b) $1$ or $-5$

(c) $0$ or $3$

(d) $2$ or $3$

(e) $-2$ or $-3$

18. If $y = \arcsin x + x\sqrt{1-x^2}$, then $\dfrac{dy}{dx} =$

(a) $2\sqrt{1-x^2}$ (correct)

(b) $\dfrac{1}{\sqrt{x^2-1}} + \dfrac{x^2}{\sqrt{1-x^2}} - \sqrt{1-x^2}$

(c) $\dfrac{-1}{\sqrt{1-x^2}} - \dfrac{x^2}{\sqrt{1-x^2}} + \sqrt{1-x^2}$

(d) $-2\sqrt{1-x^2}$

(e) $2\sqrt{x^2-1} - 1$

Math 101, 232, Major Exam II

Answer KEY

| Q | MASTER | CODE01 | CODE02 | CODE03 | CODE04 |
|---|---|---|---|---|---|
| 1 | A | D 18 | B 4 | A 17 | B 8 |
| 2 | A | D 17 | C 9 | E 3 | B 1 |
| 3 | A | B 4 | B 10 | E 15 | B 14 |
| 4 | A | D 1 | A 17 | C 16 | C 9 |
| 5 | A | C 15 | C 15 | C 13 | C 6 |
| 6 | A | D 2 | E 11 | B 6 | D 4 |
| 7 | A | D 11 | C 14 | B 12 | D 10 |
| 8 | A | A 7 | A 8 | E 8 | C 3 |
| 9 | A | B 8 | A 7 | D 1 | D 13 |
| 10 | A | D 10 | B 13 | A 4 | D 12 |
| 11 | A | C 9 | D 5 | A 11 | B 16 |
| 12 | A | E 13 | A 16 | E 14 | B 5 |
| 13 | A | E 14 | C 6 | B 2 | D 17 |
| 14 | A | C 3 | D 2 | E 10 | A 7 |
| 15 | A | D 16 | E 12 | D 9 | B 2 |
| 16 | A | E 5 | B 18 | D 7 | C 18 |
| 17 | A | E 6 | B 1 | C 5 | C 15 |
| 18 | A | E 12 | A 3 | D 18 | C 11 |