1. If $f(x) = e^x \sin x$, then $f'''(0) =$

   (a) 2 _____(correct)
   (b) $\frac{1}{2}$
   (c) π
   (d) 1
   (e) $\frac{1}{2}e^{\pi}$

2. The slope of the tangent line to the curve $y = \frac{1+\csc x}{1-\csc x}$ at $\left(\frac{\pi}{6}, -3\right)$ is equal to:

   (a) $-4\sqrt{3}$ _____(correct)
   (b) $\sqrt{3}$
   (c) -3
   (d) $2\sqrt{3}$
   (e) $\frac{2}{3}\sqrt{3}$

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

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

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

(c) $\dfrac{1}{2}e^x\left(\dfrac{1+e^x}{1-e^x}\right)$

(d) $\left(\dfrac{1+e^x}{1-e^x}\right)^2$

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

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

(a) $3^5 2^8$ (correct)

(b) $3^2 2^6$

(c) 32^9

(d) $3^4 2^6$

(e) $3^3 2^7$

5. The equation of the tangent line to the curve $\tan(x+y) = x$ at $(0,0)$ is

(a) $y = 0$ (correct)

(b) $y = x + \dfrac{\pi}{4}$

(c) $y = x - \dfrac{\pi}{4}$

(d) $y = 1$

(e) $y = -1$

6. If $y = x^{\ln x}$, $x > 0$, then $y'(e) =$

(a) 2 (correct)

(b) e

(c) $2e$

(d) e^2

(e) $\dfrac{1}{2}$

7. If $y = \sin(\cos^{-1} x)$, then $y' =$

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

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

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

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

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

8. All edges of a cube are expanding at a rate of 6 centimeters per second. How fast is the surface area changing when each edge is 3cm.

(a) $216\,cm^2/sec$ (correct)

(b) $168\,cm^2/sec$

(c) $144\,cm^2/sec$

(d) $72\,cm^2/sec$

(e) $256\,cm^2/sec$

9. Starting with $x_1 = 2$, the second Newton's approximation x_2 to the root of $x^3 - 2x - 5 = 0$ is

   (a) 2.10 (correct)
   (b) 2.01
   (c) 2.00
   (d) 1.99
   (e) 1.89

10. The sum of all critical numbers of $f(x) = \sin^2 x + \cos x$ over $(0, 2\pi)$ is

   (a) 3π (correct)
   (b) 5π
   (c) $\frac{5}{2}\pi$
   (d) $\frac{7}{2}\pi$
   (e) $\frac{3}{2}\pi$

11. The critical number of $f(x) = x^{-2} \ln x$ is

(a) $\sqrt{e}$ (correct)
(b) e^{-2}
(c) $\dfrac{1}{\sqrt{e}}$
(d) $\dfrac{1}{2}e$
(e) $e\sqrt{e}$

12. If the range of $f(x) = 3x^4 - 4x^3 - 12x^2 + 1$ over the domain $[-2, 3]$ is $[m, M]$, then $m + M =$

(a) 2 (correct)
(b) 61
(c) -30
(d) 29
(e) 24

13. If c is the number that satisfies the conclusion of the Mean Value Theorem of $f(x) = \dfrac{x}{x+2}$ over $[1, 4]$, then

(a) $2 < c < 3$ ——————————————————————————————(correct)
(b) $1 < c < 2$
(c) $3 < c < 4$
(d) $\dfrac{5}{2} < c < \dfrac{7}{2}$
(e) $\dfrac{1}{2} < c < \dfrac{3}{2}$

14. One statement is False about $f(x) = x^3 + 3x + 1$

(a) There is an interval $[a, b], a < b$, where Roll's Theorem is applicable ——(correct)
(b) $f(x)$ has at most one x-intercept
(c) $f(x)$ is differentiable over $(-\infty, \infty)$
(d) $f(x)$ has no point where the tangent line is horizontal
(e) $f'(-1) = f'(1)$