

1. Starting with $x_1 = 2$, the second approximation x_2 to the root of the equation $x^3 - 2x - 5 = 0$ is

- (a) 2.10 _____(correct)
- (b) 1.99
- (c) 1.98
- (d) 2.01
- (e) 2.21

2. If the maximum value for $f(x) = 2 \sin x - \cos 2x$ on $[0, 2\pi]$ happens at $x = a$ and the minimum value of $f(x)$ is b , then $a + b$ is equal to

- (a) $\frac{\pi - 3}{2}$ _____(correct)
- (b) $1 + \pi$
- (c) $1 - \pi$
- (d) $\frac{\pi - 1}{2}$
- (e) $\frac{\pi}{3}$

3. $f(x) = x^{4/5} (x - 4)^2$ has

- (a) 3 critical numbers _____(correct)
- (b) 2 critical numbers
- (c) 1 critical number
- (d) 4 critical numbers
- (e) no critical numbers

4. If the maximum value of $f(x) = x - \tan^{-1}(x)$ over $[0, 4]$ is A , then

- (a) $A > 0$ _____(correct)
- (b) $A < 0$
- (c) $A = 0$
- (d) $|A| > 4$
- (e) $\pi|A| < 4$

5. $f(x) = x^{-2} \ln x$ is increasing on

- (a) $(0, \sqrt{e})$ _____(correct)
(b) (e, ∞)
(c) (\sqrt{e}, ∞)
(d) $(0, \infty)$
(e) $\left(\frac{1}{2}e, e^2\right)$

6. $f(x) = (3 - x) e^{x-3}$ is decreasing over

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

7. The constant c that satisfies the Roll's Theorem of $f(x) = \frac{x^2 - 2x - 3}{x + 2}$ over $[-1, 3]$ is equal to:

- (a) $-2 + \sqrt{5}$ _____(correct)
(b) $-2 - \sqrt{5}$
(c) 0
(d) $2\sqrt{5} - 1$
(e) $1 - 2\sqrt{5}$

8. If $f(x) = Ax^2 + Bx + C$ is any polynomial over any closed interval $[a, b]$, then, the value of c that guarantee the mean value theorem is equal to:

- (a) $\frac{a + b}{2}$ _____(correct)
(b) $\frac{b - a}{2}$
(c) $\frac{a + b + c}{b - a}$
(d) $\frac{a - c}{b - a}$
(e) $\frac{b^2 - a^2}{a + b + c}$

9. One statement only is True about $f(x) = e^{\tan^{-1} x}$

- (a) f is increasing on its domain _____(correct)
- (b) f is decreasing over $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
- (c) The domain of f is $(-e, e)$
- (d) The range of $f(x)$ is $(0, \infty)$
- (e) f passes through the origin

10. $y = \ln |\csc x + \cot x|$, then $\frac{dy}{dx} =$

- (a) $-\csc x$ _____(correct)
- (b) $\csc x$
- (c) $\sec x$
- (d) $-\sec x$
- (e) $\tan x$

11. $f(x) = \sqrt{25 - x^2}$, then the slope of the tangent line at the point $(4, 3)$ is

(a) $\frac{-4}{3}$ _____(correct)

(b) $\frac{4}{3}$

(c) $\frac{-2}{5}$

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

(e) 0

12. If $F(x) = \sqrt{g(x^2)}$, and $g(4) = 4$, $g'(4) = 3$ then $F'(2) =$

(a) 3 _____(correct)

(b) 4

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

(d) $\frac{3}{4}$

(e) $\frac{3}{8}$

13. $y = (\ln x)^{x^2}$, then $\frac{dy}{dx}|_{x=e} =$

(a) e _____(correct)

(b) e^2

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

(d) $2e$

(e) $\frac{1}{e^2}$

14. $x^2 + y^2 = 4$, then $\frac{d^2y}{dx^2} =$

(a) $\frac{-4}{y^3}$ _____(correct)

(b) $\frac{-4}{y^2}$

(c) $\frac{-x}{y^3}$

(d) $\frac{x^2}{y^2}$

(e) $\frac{-4}{y}$

15. Let $f(x) = \frac{x+6}{x-2}$, $x > 2$, then $(f^{-1})'(3) =$

(a) -2 _____(correct)

(b) $-\frac{1}{8}$

(c) 2

(d) 8

(e) $-\frac{1}{2}$

16. Let $y = x \tan^{-1}(2x) - \frac{1}{4} \ln(1 + 4x^2)$, then $\frac{dy}{dx} =$

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

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

(c) $\tan^{-1}(2x) - \frac{1}{1 + 4x^2}$

(d) $\tan^{-1}(2x) + \frac{1}{1 + 4x^2}$

(e) $\tan^{-1}\left(\frac{x}{1 + 4x^2}\right)$

17. All edges of a cube are expanding at a rate 4 centimeters per second. How fast the volume changing when each edge is 1 centimeter?

- (a) 12 centimeter³ per second _____(correct)
- (b) 3 centimeter³ per second
- (c) 4 centimeter³ per second
- (d) 1 centimeter³ per second
- (e) 8 centimeter³ per second

18. A water tank has the shape of an inverted circular cone with base radius $2m$ and height $4m$. If water is being pumped into the tank at a rate $2m^3/\text{min}$, at which rate the water level is rising when the water is $3m$ deep. $\left(v = \frac{1}{3}\pi r^2 h\right)$

- (a) $\frac{8}{9\pi} m/\text{min}$ _____(correct)
- (b) $\frac{8}{3}\pi m/\text{min}$
- (c) $\frac{\pi}{9} m/\text{min}$
- (d) $8\pi m/\text{min}$
- (e) $9\pi m/\text{min}$