1. The slope the tangent line to the curve with equation $y = \dfrac{x+3}{1-x}$ at $x = -2$ is

   (a) $\dfrac{4}{9}$

   (b) $\dfrac{5}{9}$

   (c) undefined

   (d) 4

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

2. If $y = \sin 2x - \cos 2x$, then $y^{(4)}(0) =$

   (a) -16

   (b) 24

   (c) 0

   (d) -8

   (e) 32

3. If $y = \cot^3(x^2)$, then $y'\left(\frac{\sqrt{\pi}}{2}\right) =$

(a) $-6\sqrt{\pi}$

(b) $\sqrt{2\pi}$

(c) $\sqrt{3\pi}$

(d) $3\sqrt{\pi}$

(e) $-2\sqrt{3\pi}$

4. If $y = \left(\frac{1+e^u}{e^u}\right)^2$ and $u = \frac{1+x}{x}$, then the value of $\frac{dy}{dx}$ when $x = 1$ is equal to

(a) $2(e^{-2} + e^{-4})$

(b) $-2\,e^{-2}$

(c) 0

(d) $-2(e^{-2} + 1)$

(e) $e^2 + e$

5. The slope of the tangent line to the curve $\sin(x+y) = xy$ at the point $(0,0)$ is

(a) -1

(b) 1

(c) 0

(d) -2

(e) 53

6. If $y = \tan^{-1}(\ln x)$, then $\dfrac{dy}{dx} =$

(a) $\dfrac{1}{x(1+(\ln x)^2)}$

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

(c) $\dfrac{1}{1+\ln x}$

(d) $\dfrac{1}{1+x\ln x}$

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

7. The variables x and y are differentiable functions of a variable t and are related by the equation $x^2 + xy + y^2 = 19$. If $\dfrac{dx}{dt} = -1$ when $x = 2$ and $y = 3$, then the corresponding value of $\dfrac{dy}{dt}$ is

(a) $\dfrac{7}{8}$

(b) $\dfrac{1}{4}$

(c) $\dfrac{3}{8}$

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

(e) $\dfrac{1}{8}$

8. If $(0, \beta)$ is a point on the tangent line to the graph of $y = -\pi + 4\sin^{-1}\left(\dfrac{1}{x}\right)$ at $x = \sqrt{2}$, then $\beta =$

(a) 4

(b) -4

(c) $2\sqrt{2}$

(d) $-2\sqrt{2}$

(e) 0

9. A ladder $15\,ft$ long rests against a vertical wall. If the bottom of the ladder slides away from the wall horizontally at a rate of $4\,ft/sec$. How fast is the ladder sliding down the wall when the top of the ladder is $12\,ft$ from the ground?

(a) $-3\,ft/sec$

(b) $\frac{3}{2}\,ft/sec$

(c) $-\frac{3}{2}\,ft/sec$

(d) $3\,ft/sec$

(e) $-6\,ft/sec$

10. If $y = \ln(\sec x + \tan x)$, then $y'' =$

(a) $\sec x \, \tan x$

(b) $\sec x$

(c) $\tan x$

(d) $\sec^2 x$

(e) $\tan^2 x$

11. If a linear approximation is used to approximate $\sin(59^\circ)$, we get $\sin(59^\circ) \approx a + b\left(\frac{\pi}{180}\right)$, then $\frac{2}{\sqrt{3}}\, a + 2b$ is equal to

(a) 0

(b) 2

(c) -2

(d) 1

(e) -1

12. If $3x^2 + 4y^2 = 4$, then $\frac{d^2y}{dx^2} =$

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

(b) $\frac{12}{y^3}$

(c) $\frac{-12}{y^3}$

(d) $\frac{-1}{4y^3}$

(e) $\frac{-6}{y^3}$

13. At time t, the position of a body moving along the s-axis is $s(t) = t^3 - 6t^2 + 9t$ (s in meters, t in seconds). Find the body's acceleration at the first time the velocity is zero.

(a) $-6\ m/sec^2$

(b) $0\ m/sec^2$

(c) $1\ m/sec^2$

(d) $3\ m/sec^2$

(e) $-4\ m/sec^2$

14. If $y = \tan\left(\dfrac{\cos x}{x}\right)$, then $x^2 \cos^2\left(\dfrac{\cos x}{x}\right) \dfrac{dy}{dx} + \cos x =$

(a) $-x \sin x$

(b) $x \cos x$

(c) $-\dfrac{\sin x}{x}$

(d) $\dfrac{\cos x}{x}$

(e) $\sec\left(\dfrac{\cos x}{x}\right)$

15. If $y = \dfrac{(x-1)(2x-1)^2}{(3x-1)^3(4x-1)^4}$, then $y'(0) =$

(a) 20

(b) 21

(c) -21

(d) -20

(e) 19

16. The area of a circle is decreasing at a rate of $\dfrac{8\pi}{9}\, cm^2/min.$ At what rate is the radius of the circle changing when the area is $\dfrac{\pi}{9}\, cm^2$?

(a) $\dfrac{-4}{3}\ cm/min$

(b) $2\,\pi\ cm/min$

(c) $\dfrac{4}{3}\ cm/min$

(d) $-2\,\pi\ cm/min$

(e) $-2\ cm/min$

17. The equation of the normal line to the curve $y = x^2 + 1$ that is parallel to the line $x + y = 2$ is

(a) $4y + 4x = 7$

(b) $y + x = 2$

(c) $3y + 2x = 1$

(d) $y = x$

(e) $y = -x$

18. If $y = x^y$, then $y' =$

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

(b) x^{y-1}

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

(d) $\dfrac{xy}{y + \ln x}$

(e) $\dfrac{y}{x - y}$

19. The slope of the tangent line to the graph of $y = \sqrt{x + \sqrt{x^2 + 5}}$ at $x = 2$ is

(a) $\dfrac{\sqrt{5}}{6}$

(b) $\dfrac{2\sqrt{5}}{3}$

(c) $\sqrt{5}$

(d) $\dfrac{\sqrt{5}}{2}$

(e) $\dfrac{\sqrt{5}}{9}$

20. The radius of a circular disk is given as $24\,cm$ with a maximum error in measurement of $0.2\,cm$. Use differentials to estimate the relative error in the calculated area of the base of the disk.

(a) $\dfrac{1}{60}$

(b) $\dfrac{1}{40}$

(c) $\dfrac{1}{20}$

(d) $\dfrac{1}{12}$

(e) $\dfrac{1}{80}$