1. Which one of the following statements is true about $g(x) = \dfrac{x-1}{|x-1|}$,

   (a) $\lim\limits_{x\to 1} g(x)$ does not exist _____(correct)

   (b) $\lim\limits_{x\to 1} g(x) = 0$

   (c) $\lim\limits_{x\to 1} g(x) = 1$

   (d) $x = 1$ is a vertical asymptote

   (e) $\lim\limits_{x\to -1} g(x) = -\infty$

2. $\lim\limits_{x\to 1}\left(\dfrac{2x-2x^2}{1-x}\right) = 2$, then the largest value of δ such that $|f(x)-2| < \epsilon$ whenever $0 < |x-1| < \delta$ is

   (a) $\dfrac{\epsilon}{2}$ _____(correct)

   (b) ϵ

   (c) 2ϵ

   (d) 4ϵ

   (e) $\dfrac{\epsilon}{4}$

3. $\lim_{x\to 1} \dfrac{\sin(x-1)}{x^2-1} =$

(a) $\dfrac{1}{2}$ (correct)

(b) 0

(c) $-\infty$

(d) ∞

(e) 1

4. $\lim_{x\to 0} \dfrac{2-2e^{-x}}{e^x-1} =$

(a) 2 (correct)

(b) 1

(c) 0

(d) ∞

(e) $-\infty$

5. $\lim_{x\to 2^-} [\![\frac{x}{2}]\!] - \frac{x}{2} =$

(where $[\![x]\!]$ is the greatest integer function)

(a) -1 (correct)

(b) 0

(c) 1

(d) does not exist

(e) 2

6. If the constant $a > 0$ such that the function

$$f(x) = \begin{cases} \frac{x^3-a^3}{x-a} & x \neq a \\ 12 & x = a \end{cases}$$

is continuous over $(-\infty, \infty)$, then $a^2 + a =$

(a) 6 (correct)

(b) 2

(c) 8

(d) 0

(e) 4

7. Given $g(x) = \begin{cases} x^2 \sin \frac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$, then

(a) g is differentiable at $x = 0$ and $g'(0) = 0$ _____(correct)

(b) g is differentiable at $x = 0$ and $g'(0) = 1$

(c) g is not differentiable at $x = 0$

(d) g is not continuous at $x = 0$

(e) $\lim_{x \to 0} g(x) = 1$

8. Let $p(x) = g(x)\,(f(2x))^2$, $g'(1) = 0$, $g(1) = 2$, $f(2) = 2$, $f'(2) = 3$, then $p'(1) =$

(a) 48 _____(correct)

(b) 46

(c) 24

(d) 12

(e) 32

9. Let $g(x) = \dfrac{x(x^2+1)^2}{\sqrt{2x^3-1}}$, then $g'(2) =$

(a) $\dfrac{13\sqrt{15}}{3}$ (correct)

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

(c) $\dfrac{5\sqrt{15}}{3}$

(d) $\sqrt{5}$

(e) $\dfrac{13\sqrt{15}}{6}$

10. The slope of the tangent line to the graph $y^2 + \ln xy = 2$ at the point $(e, 1)$ is

(a) $\dfrac{-1}{3e}$ (correct)

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

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

(d) $\dfrac{-1}{e}$

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

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

(a) -1 _____(correct)

(b) 1

(c) 0

(d) 2

(e) -2

12. A ladder 5 meters long is leaning against the wall of house. The base of the ladder is pulled away from the wall at rate $\dfrac{1}{2}$ meter per second. The rate at which the angle between the ladder and wall is changing when the base of the ladder is 4 meters from the wall is:

(a) $\dfrac{1}{6}\, rad/sec$ _____(correct)

(b) $\dfrac{1}{4}\, rad/sec$

(c) $\dfrac{1}{3}\, rad/sec$

(d) $\dfrac{1}{9}\, rad/sec$

(e) $\dfrac{1}{2}\, rad/sec$

13. The number of vertical asymptotes of $f(x) = \dfrac{\ln(x^2-4)}{(x-1)(x-3)}$ is

(a) 3 _____ (correct)

(b) 0

(c) 1

(d) 2

(e) 4

14. The graph of $f(x) = e^{(2/x)}$ is concaving downward over the interval:

(a) $(-\infty, -1)$ _____ (correct)

(b) $(-\infty, e)$

(c) $(-\infty, \sqrt{e})$

(d) $(-\infty, 2)$

(e) $\left(-\infty, \dfrac{1}{2}\right)$

15. One statement is **False** about $f(x) = \dfrac{\sin x}{x}$

(a) The maximum value of $f(x)$ is 1 _____(correct)

(b) $f(x)$ is an even function

(c) $\lim\limits_{x\to 0} f(x) = 1$

(d) $y = 0$ is a horizontal asymptote for $f(x)$

(e) $f(x)$ has no vertical asymptote

16. If the inflection points for $f(x) = \dfrac{(x+1)^2}{1+x^2}$ happen at $x = \pm\sqrt{b}$, then the possible value of b is

(a) 3 _____(correct)

(b) 2

(c) 1

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

(e) $\dfrac{1}{3}$

17. $\lim_{x\to\infty}\left(\dfrac{1}{2x+\cos x}\right)$

(a) equals 0 _____(correct)

(b) equals 1

(c) equals $\dfrac{2}{\pi}$

(d) limit does not exist

(e) limit cannot be evaluated

18. $\lim_{x\to\infty} x\sin\left(\dfrac{1}{x}\right) =$

(a) 1 _____(correct)

(b) 0

(c) $+\infty$

(d) $-\infty$

(e) -1

19. $\lim_{x\to-\infty}\left(2-\dfrac{x+x^3}{1+x+x^2-3x^3}\right)$ is

(a) $\dfrac{7}{3}$ ——————————————————————————————(correct)

(b) $\dfrac{1}{3}$

(c) $\dfrac{-1}{3}$

(d) $\dfrac{5}{3}$

(e) 2

20. The range of $f(x)=\dfrac{\cos x}{2+\sin x}$ is

(a) $\left[\dfrac{-\sqrt{3}}{3},\dfrac{\sqrt{3}}{3}\right]$ ——————————————————————————————(correct)

(b) $[-1,2]$

(c) $\left[\dfrac{-1}{2},\dfrac{1}{2}\right]$

(d) $[0,2]$

(e) $\left[\dfrac{-\sqrt{2}}{2},\dfrac{\sqrt{2}}{2}\right]$

21. The minimum vertical distance between the parabolas $y = x^2 + 1$ and $y = x - x^2$ is

(a) $\frac{7}{8}$ _____(correct)

(b) $\frac{5}{8}$

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

(d) $\frac{1}{8}$

(e) $\frac{9}{8}$

22. The radius r of a circle increases from $10\,m$ to $10.1\,m$. Using differential, the estimate of the increase of the area of the circle is

(a) $102\,\pi\,m^2$ _____(correct)

(b) $100\,\pi\,m^2$

(c) $101\,\pi\,m^2$

(d) $100.5\pi\,m^2$

(e) $100.1\pi\,m^2$

23. $\lim_{x\to 1^-} (2-x)^{\tan\left(\frac{\pi}{2}x\right)} =$

(a) $e^{2/\pi}$ _____(correct)

(b) $e^{-\pi}$

(c) $e^{-\sqrt{2}}$

(d) $e^{-\pi}$

(e) $e^{1/2}$

24. $\lim_{x\to 0} \left(\frac{\sinh x - x}{x^3}\right) =$

(a) $\frac{1}{6}$ _____(correct)

(b) $\frac{1}{3}$

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

(d) 1

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

25. One statement is **False** about $f(x) = \tanh x$

(a) $f(\ln x) = \dfrac{x^2+1}{x^2-1}$ _____(correct)

(b) $f(x)$ has 2 horizontal asymptotes

(c) $f(x)$ is an odd function passing through the origin

(d) $f(x)$ is increasing on its domain

(e) $f'(x) = \operatorname{sech}^2 x$

26. $\displaystyle\int \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2 dx =$

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

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

(c) $\dfrac{2}{3}x^{3/2} + 2\sqrt{x} + C$

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

(e) $\dfrac{2}{3}\sqrt{x}(1 + \ln x) + C$

27. The global minimum value of $f(x) = (x-3)\sqrt{x}$ is at the point

(a) $(1, -2)$ _____ (correct)

(b) $(0, 0)$

(c) $(3, 0)$

(d) $(4, 2)$

(e) $\left(\frac{1}{2}, \frac{-5}{2\sqrt{2}}\right)$

28. Starting with $x_0 = 0$, the second approximation x_2 to the root of the equation $x^3 + x + 1 = 0$ is

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

(b) 0

(c) -1

(d) $-\frac{5}{4}$

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