1. If $(a, b)$ is the inflection point of the function $f(x) = x^3 - 3x + 2$, then $a + b =$

   (a) 2 _____(correct)
   (b) $-1$
   (c) 1
   (d) $-2$
   (e) 0

2. The function $f(x) = x^4 - 4x^3$ is concave down over

   (a) $(0, 2)$ _____(correct)
   (b) $(0, 3)$
   (c) $(-\infty, 0)$
   (d) $(2, \infty)$
   (e) $(0, 2) \cup (3, \infty)$

3. For a polynomial function $f$, the only critical point is at $x = 3$ and $f''(3) = -2$, then

   (a) $f(x)$ has absolute maximum at $x = 3$ _____(correct)
   (b) $f(x)$ has absolute minimum at $x = 3$
   (c) $f(x)$ has inflection point at $x = 3$
   (d) $f(x)$ has no relative extrema
   (e) $f(x)$ has no absolute extrema

4. The function $f(x) = \dfrac{x+5}{x^2}$ has

   (a) one vertical asymptote and one horizontal asymptote _____(correct)
   (b) one vertical asymptote and no horizontal asymptote
   (c) one vertical asymptote and slant asymptote
   (d) only one asymptote
   (e) no asymptotes

5. The function $f(x) = \dfrac{x^2}{x+1}$ has

   (a) $y = x - 1$ as a slant asymptote _____(correct)
   (b) no vertical asymptotes
   (c) no slant asymptote
   (d) one slant asymptote and one horizontal asymptote
   (e) $y = x + 1$ as a slant asymptote

6. Which of the following statements is **FALSE** for the function $f(x) = 2e^x - 1$,

   (a) $f(x)$ has one critical point _____(correct)
   (b) $y = -1$ is a horizontal asymptote
   (c) no vertical asymptotes
   (d) always increasing
   (e) always concave up

7. A TV cable company has 4000 subscribers who are each paying monthly \$24. It can get 100 more subscribers for each \$0.5 decreasing in the monthly fee. The price that will make the maximum revenue is

   (a) 22 _____(correct)
   (b) 20
   (c) 18
   (d) 21
   (e) 16

8. Let $y = f(x) = 2x^3 + 17$ and $x$ changes from $-1$ to $-1.03$ then $dy \approx$

   (a) $-0.18$ _____(correct)
   (b) 0.18
   (c) $-0.9$
   (d) 0.9
   (e) 0.6

9. Using differentials, $e^{1.1} \approx$

(a) $(1.1)e$ (correct)
(b) $e$
(c) $e + 1$
(d) $e - 1$
(e) $(1.2)e$

10. If the demand equation of a product is $p = -5q + 30$, where $p$ is the price and $q$ is the number of units, then the price that maximize the revenue is

(a) 15 (correct)
(b) 10
(c) 20
(d) 25
(e) 45

11. The function $f(x) = x^{\frac{2}{3}}$ increasing on the interval

(a) $[0, \infty)$ _____(correct)
(b) $(-\infty, 0]$
(c) $[-1, \infty]$
(d) $(-\infty, -1)$
(e) $(-\infty, -1) \cup [0, \infty)$

12. The relative maximum of the graph of $f(x) = x + \dfrac{4}{x+1}$ is

(a) $-5$ _____(correct)
(b) $-3$
(c) $1$
(d) $3$
(e) $-7$

13. If $x^2 + 4y^2 = 16$, then $\dfrac{d^2y}{dx^2} =$

(a) $\dfrac{-1}{y^3}$ _____(correct)

(b) $\dfrac{x}{y^3}$

(c) $\dfrac{x}{16y^3}$

(d) $\dfrac{-x}{y^3}$

(e) $\dfrac{-x}{16y^3}$

14. If $y = e^{x^2+1}$ then $y''(1) = \ldots$

(a) $6e^2$ _____(correct)

(b) $12e^2$

(c) $8e^2$

(d) $12e$

(e) $20e$

15. The slope of the tangent line to the curve $y = (1 + e^x)^{\ln x}$ at $(1, 1)$ is

(a) $\ln(1 + e)$ _____(correct)
(b) 0
(c) 1
(d) $\ln(e - 1)$
(e) 2

16. The equation of tangent line to $y = (x - 1)(x - 2)^2(x + 2)^3$ at the point $x = 0$ is

(a) $y = 16x - 32$ _____(correct)
(b) $y = 16x + 32$
(c) $y = \frac{-1}{2}x + 32$
(d) $y = \frac{-1}{2}x - 32$
(e) $y = x$

17. The slope of the curve $x^2 = (y - x^2)^2$ at $(1, 0)$ is

(a) 1 _____(correct)
(b) $-1$
(c) 2
(d) 0
(e) $-2$

18. If $x - y = xy$, then $\frac{dy}{dx}|_{x=1} = \ldots$

(a) $\frac{1}{4}$ _____(correct)
(b) $\frac{1}{2}$
(c) $\frac{-1}{2}$
(d) 2
(e) $\frac{-1}{4}$

19. If $M$ is absolute maximum and $m$ is absolute minimum of the function

$$f(x) = -3x^5 + 5x^3 \text{ on } [-2, 0]$$

then $M + m =$

(a) 54 _____ (correct)
(b) 58
(c) 60
(d) 52
(e) 62

20. The function $f(x) = x^2 e^x$ has

(a) two inflection points _____ (correct)
(b) one inflection point
(c) no inflection points
(d) a relative maximum at $x = 0$
(e) a relative minimum at $x = -2$