Key

1. The number of roots of the equation $e^x = 3 - 2x$ in the interval $[0, 1]$ is:

(a) 1

(b) 0

(c) 2

(d) 3

(e) 4

Let $f(x) = e^x + 2x - 3$.

$f(0) = -3 < 0$

$f(1) = e + 2 - 3 > 0$

By the Intermediate Value Theorem, $f(x)$ has at least one root in $[0,1]$.

Notice that $f'(x) = e^x + 2 > 0$ $\forall x \in [0,1]$ whence $f(x)$ is increasing on $[0,1]$.

$\therefore$ $f(x)$ has exactly one root in $[0,1]$.

2. The function $f(x) = \sin x + \cos x$ has on the interval $[0, \pi]$:

(a) an absolute minimum at $x = \pi$ and an absolute maximum at $x = \frac{\pi}{4}$

(b) an absolute minimum at $x = 0$ and an absolute maximum at $x = \frac{\pi}{4}$

(c) an absolute minimum at $x = \pi$ and an absolute maximum at $x = 0$

(d) an absolute maximum but no absolute minimum

(e) an absolute minimum but no absolute maximum

$f'(x) = \cos x - \sin(x)$.

$f'(x) = 0 \Rightarrow \cos x = \sin x \Rightarrow \tan x = 1$

$\therefore x = \frac{\pi}{4}$ & $x = \frac{3\pi}{4}$ are the critical numbers in $[0, \pi]$.

$f(\frac{\pi}{4}) = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$

$f(\frac{3\pi}{4}) = \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}} = 0$.

x	$f(x)$	
0	1	
$\frac{\pi}{4}$	$\sqrt{2}$	absolute maximum
$\frac{3\pi}{4}$	0	
π	-1	absolute minimum

3. The function $f(x) = x^2(x-9)^7$ is decreasing on the interval

$$f'(x) = 2x\cdot(x-9)^7 + x^2\cdot 7(x-9)^6$$
$$= (x-9)^6\left(2x(x-9) + 7x^2\right)$$
$$= (x-9)^6\left(2x^2 - 18x + 7x^2\right)$$
$$= (x-9)^6\left(9x^2 - 18x\right)$$
$$= (x-9)^6\,(9x)(x-2)$$
$$f'(x) = 0 \Rightarrow x = 0 \text{ or } x = 2.$$

(a) $(0, 2)$

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

(c) $(-\infty, 0)$

(d) $(2, 9)$

(e) $(9, \infty)$

$f'(x)$: $++++$ | 0 | $----$ | 2 | $++++$ | 9 | $++++$

$f(x)$: ↗ | 0 | ↘ | 2 | ↗ | 9 | ↗

f decreases on $(0, 2)$

4. The number of **local** extreme values of $f(x) = x^4 - 3x^2 - 1$ on the interval $[-2, 2]$ is (**Hint:** You may sketch the graph)

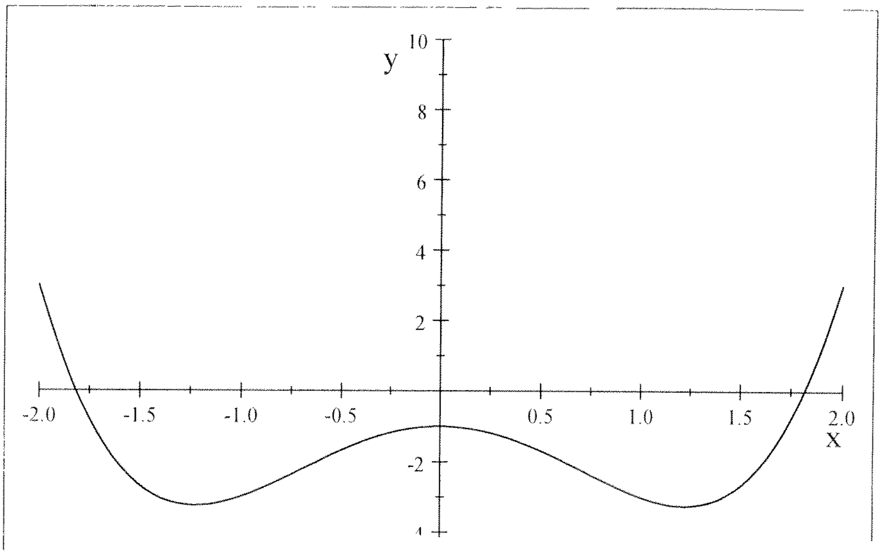
(a) 2

(b) 0

(c) 1

(d) 3

(e) 4



$f'(x) = 4x^3 - 6x = 2x(2x^2 - 3)$

$f'(x) = 0 \Rightarrow x = 0$ or $x = \mp\sqrt{\frac{3}{2}}$

$f''(x) = 12x^2 - 6$

x	$f(x)$	$f''(x)$	
0	-1	-6	local max: -1
$\mp\sqrt{\frac{3}{2}}$	$-\frac{13}{4}$	12	local min. is $-\frac{13}{4}$

Notice that

$f(-\sqrt{\frac{3}{2}}) = f(\sqrt{\frac{3}{2}})$

and so $f(x)$ has

one local minimum.

5. The number of critical numbers of $f(x) = x^{1/3} - x^{-2/3}$ is

(a) 1

(b) 0

(c) 4

(d) 2

(e) 3

$$f'(x) = \frac{1}{3}x^{-\frac{2}{3}} - \left(\frac{-2}{3}x^{-\frac{5}{3}}\right)$$

$$= \frac{x^{-\frac{2}{3}} + 2x^{-\frac{5}{3}}}{3}$$

multiply by $\frac{x^{\frac{5}{3}}}{x^{\frac{5}{3}}}$ to get

$$f'(x) = \frac{x+2}{3x^{5/3}}.$$

$f'(x) = 0 \Rightarrow x = -2.$

Critical number is $x = -2$. Notice $0 \notin \mathrm{Dom}(f)$

6. $\displaystyle\lim_{x\to 0^+}\left(\frac{1}{\ln(1+x)} - \frac{1}{x}\right) = L$

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

(b) ∞

(c) $-\infty$

(d) 0

(e) 1

$$L = \lim_{x\to 0^+} \frac{x - \ln(1+x)}{\ln(1+x)\cdot x} \quad \left(\frac{0}{0}\right)$$

$$\overset{L.R.}{=} \lim_{x\to 0^+} \frac{1 - \frac{1}{x+1}}{\frac{1}{x+1}\cdot x + \ln(1+x)\cdot 1}$$

$$= \lim_{x\to 0^+} \frac{(x+1-1)/\cancel{(x+1)}}{[x + \ln(1+x)\cdot(x+1)]/\cancel{(x+1)}}$$

$$= \lim_{x\to 0^+} \frac{x}{x + \ln(1+x)\cdot(x+1)} \quad \left(\frac{0}{0}\right)$$

$$= \lim_{x\to 0^+} \frac{1}{1 + \left(\frac{1}{x+1}\cdot (x+1) + \ln(1+x)\cdot 1\right)}$$

$$= \frac{1}{1 + (1+0)} = \frac{1}{2}.$$

7. If

$$f(x) = \begin{cases} 2, & x = 0 \\ mx + r, & 0 < x \le 2 \\ -x^2 + 6x + q, & 2 < x \le 3 \end{cases}$$

$f'(x) = \begin{cases} m : 0<x<2 \\ \boxed{2} : x = 2 \\ -2x+6 : 2<x<3 \end{cases}$

satisfies the hypotheses of the Mean-Value Theorem on $[0, 3]$, then $r + m + q =$

f(x) continuous on [0,3].

(a) 2

$\lim_{x\to 0^+} f(x) = f(0)$

(b) 4

$\boxed{r = 2}$

(c) -2

$\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} f(x)$

(d) -4

$2m + r = 8 + q$

(e) 0

$\boxed{2m = 6 + q}$ (using $r = 2$).

f differentiable on (0,3).

$f'_-(2) = f'_+(2)$

$\boxed{m = 2}$ $\boxed{q = -2}$

$\therefore$ $r + m + q = 2 + 2 - 2 = 2$

8. Let $x^2 + y^2 + z^2 = 9$, $\dfrac{dx}{dt} = 5$ and $\dfrac{dy}{dt} = 4$. When $x = 2, y = 2$ and $z = 1$, we have $\dfrac{dz}{dt} =$

(a) -18

$\cancel{2}x \cdot \frac{dx}{dt} + \cancel{2}y \cdot \frac{dy}{dt} + \cancel{2}z \cdot \frac{dz}{dt} = 0$

(b) -16

$(\cancel{2})(2)(5) + (\cancel{2})(2)(4) + \cancel{2}(1)\frac{dz}{dt} = 0$

(c) -14

$10 + 8 + \frac{dz}{dt} = 0$.

(d) 14

(e) 16

$\therefore$ $\boxed{\frac{dz}{dt} = -18}$

9. A particle is moving along the hyperbola $xy = 8$. As it reaches the point $(4, 2)$, the y-coordinate is $\boxed{\text{decreasing}}$ at a rate of $3\,cm/s$. The x-coordinate at that instant is

(a) increasing at a rate of $6\,cm/s$

(b) decreasing at a rate of $6\,cm/s$

(c) increasing at a rate of $4\,cm/s$

(d) decreasing at a rate of $4\,cm/s$

(e) decreasing at a rate of $2\,cm/s$

$$xy = 8$$

$$\frac{dx}{dt} \cdot y + x \cdot \frac{dy}{dt} = 0.$$

$$\frac{dx}{dt} = \frac{-x \cdot \frac{dy}{dt}}{y}$$

$$= \frac{-(4)\cdot(-3)}{2}$$

$$= 6 > 0.$$

10. If $f'(x) = \pi^x + x^e + \pi^e$ and $f(0) = \dfrac{1}{\ln \pi} + 1$, then $f(x) =$

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

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

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

(d) $\pi^x + \dfrac{x^{e+1}}{e+1} + \pi^e x + 1$

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

$f(x)$ is the antiderivative of $f'(x)$.

$$f(x) = \frac{\pi^x}{\ln\pi} + \frac{x^{e+1}}{e+1} + \pi^e x + C$$

$$f(0) = \frac{1}{\ln\pi} + 1$$

$$\frac{1}{\ln\pi} + \{0 + 0\} + C = \frac{1}{\ln\pi} + 1$$

$$\therefore \boxed{C = 1}$$

$$f(x) = \frac{\pi^x}{\ln\pi} + \frac{x^{e+1}}{e+1} + \pi^e x + 1$$

11. A particle moves in a straight line and has an acceleration $a(t) = 6t + 4\ cm/s^2$. If its initial velocity is $v(0) = -6\ cm/s$ and its initial displacement is $s(0) = 9\ cm$, then $s(1)$ (in cm) is equal to

(a) 6
(b) 0
(c) 2
(d) 4
(e) 8

• $v(t) = 3t^2 + 4t + c_1$

$v(0) = -6 \Longrightarrow \boxed{c_1 = -6}$

• $\therefore v(t) = 3t^2 + 4t - 6$

• $s(t) = t^3 + 2t^2 - 6t + c_2$

$s(0) = 9 \Longrightarrow \boxed{c_2 = 9}$

• $\therefore s(t) = t^3 + 2t^2 - 6t + 9.$

$s(1) = 1 + 2 - 6 + 9$

$= 6.$

12. Let $F(x) = e^{xf(x^2)}$. If $f(4) = 2$ and $f'(4) = 3$, then $F'(2) =$

(a) $26\,e^4$
(b) e^{104}
(c) $14\,e^4$
(d) $48\,e^4$
(e) e^{56}

$F'(x) = e^{xf(x^2)} \cdot (1 \cdot f(x^2) + x \cdot f'(x^2) \cdot 2x)$

$F'(2) = e^{2f(4)}\left(f(4) + (2)(f'(4))(4) \right)$

$= e^{(2)(2)}\left(2 + (2)(3)(4)\right)$

$= 26 e^4.$

13. The slope of the line tangent to the curve $\boxed{y^3 - xy^2 + \cos(xy) = 2}$ at the point $(0,1)$ is

$m_{\text{tangent}} = \left.\frac{dy}{dx}\right|_{(0,1)}$

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

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

(c) $\frac{1}{4}$

(d) 1

(e) 3

$$\boxed{3y^2 \cdot \frac{dy}{dx} - (1 \cdot y^2 + x \cdot 2y \cdot y') - \sin(xy) \cdot (1 \cdot y + x \cdot y') = 0.}$$

Setting $x = 0$ & $y = 1$, we obtain:

$$3 \cdot \left.\frac{dy}{dx}\right|_{(0,1)} - (1+0) - 0 = 0$$

$$\boxed{\left.\frac{dy}{dx}\right|_{(0,1)} = \frac{1}{3}}$$

14. $\lim_{x \to 0^+} (1 + \sin(3x))^{\cot x} = L$

(a) e^3

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

(c) ∞

(d) $\ln(3)$

(e) $-\ln(3)$

$$\ln L = \ln\left(\lim_{x\to 0^+} (1+\sin(3x))^{\cot x}\right)$$

$$= \lim_{x\to 0^+} \left(\ln(1+\sin(3x))^{\cot x}\right)$$

$$= \lim_{x\to 0^+} (\cot x) \cdot \ln(1+\sin(3x))$$

$$= \lim_{x\to 0^+} \frac{\ln(1+\sin(3x))}{\tan x} \quad \left(\frac{0}{0}\right)$$

$$\boxed{\text{L.Ru}} = \lim_{x\to 0^+} \left(\frac{\frac{3\cos(3x)}{1+\sin(3x)}}{\sec^2(x)}\right)$$

$$= \left(\frac{\frac{(3)\,(1)}{1+0}}{1}\right) = 3.$$

$\ln L = 3$

$\therefore \boxed{L = e^3}$

15. If we use Newton's Method to approximate the solution for $2x - 3\cos x = 0$ starting with $x_1 = \frac{\pi}{2}$, then the second approximation is $x_2 =$

(a) $\frac{3\pi}{10}$

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

(c) $\frac{\pi}{5}$

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

(e) $\frac{2\pi}{3}$

let $f(x) = 2x - 3\cos x$.

$f'(x) = 2 + 3\sin x$.

$f(x_1) = \pi$

$f'(\frac{\pi}{2}) = 5$

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$$

$$= \frac{\pi}{2} - \frac{\pi}{5}$$

$$= \frac{5\pi - 2\pi}{10} = \frac{3\pi}{10}$$

16. The hypotheses of the Mean-Value Theorem are satisfied for:

✓ (a) $f(x) = \cos(x)$ on $[0, 4\pi]$

(b) $f(x) = \sqrt[5]{|x|}$ on $[-1, 1]$

(c) $f(x) = \frac{1}{\cos(x)}$ on $[0, 4\pi]$

(d) $f(x) = x^{\frac{1}{3}} - x + 1$ on $[-1, 1]$

✓ (e) $f(x) = x^{\frac{1}{2}}$ on $[0, 1]$

$f(x) = \cos(x)$ continuous on $[0, 4\pi]$

$f'(x) = -\sin x$

$\therefore f$ differentiable on $(0, 4\pi)$.

$f(x) = \sqrt{x}$ continuous on $[0, 1]$.

$f'(x) = \frac{1}{2\sqrt{x}}$, $x > 0$

f differentiable on $(0, 1)$.

Note There were two correct solutions for this questions. Any answer (a) or (e) was considered correct.

17. $\lim_{x \to 1} [(x-1)\coth(\ln x)] = L$

(a) 1

(b) ∞

(c) 2

(d) 0

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

$\coth(u) = \dfrac{e^u + e^{-u}}{e^u - e^{-u}}$

$\coth(\ln x) = \dfrac{e^{\ln x} + e^{-\ln x}}{e^{\ln x} - e^{-\ln x}} = \dfrac{x + \frac{1}{x}}{x - \frac{1}{x}} = \dfrac{(x^2+1)/\cancel{x}}{(x^2-1)/\cancel{x}} = \dfrac{(x^2+1)}{(x-1)(x+1)}$

$L = \lim_{x \to 1} \dfrac{\cancel{(x-1)}(x^2+1)}{\cancel{(x-1)}(x+1)} = \dfrac{2}{2} = 1$

18. If $y = \dfrac{1 + \tanh x}{1 - \tanh x}$, then $y'(\ln 2) =$

(a) 8

(b) 6

(c) 4

(d) 2

(e) 0

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

$y = e^{2x}$

$y' = 2 \cdot e^{2x}$

$y'(\ln 2) = 2 e^{2\ln(2)}$

$= 2 \cdot e^{\ln(4)}$

$= (2)(4)$

$= 8$

19. The volume of a cube was found to be $8\,cm^3$ with possible error of $0.1\,cm$ in the measurement of its edge.
Using differentials, the estimation of the maximum possible error in computing its volume (in cm^3) is

(a) 1.2

(b) 1.4

(c) 0.8

(d) 1

(e) 0.6

Let x = side of the cube.

$V = x^3$; $x = 2$.

$dV = 3x^2 \cdot dx$.

$\therefore \Delta V \approx dV = (3)(2)^2 \cdot (0.1)$
$= (12)(0.1)$
$= 1.2$.

20. The linearization of $f(x) = \cos(x)$ at $x = 0$ is $L(x) =$

(a) 1

(b) $x + 1$

(c) $x - 1$

(d) $2x + 1$

(e) $1 - x$

$f'(x) = -\sin(x)$.

$L(x) = f(x_0) + f'(x_0) \cdot (x - x_0)$.

$= f(0) + f'(0) \cdot (x - 0)$

$= 1 + 0 \cdot (x)$

$\boxed{L(x) = 1.}$

21. The number of inflection points $f(x) = x^2 - x - \ln x$ is

(a) 0

(b) 1

(c) 2

(d) 3

(e) 4

$f'(x) = 2x - 1 - \frac{1}{x}$

$f''(x) = 2 + \frac{1}{x^2}$

Since $f''(x) > 0 \quad \forall\, x \in (0, \infty)$,

$f(x)$ is concave up on $(0, \infty)$.

$\therefore$ $f(x)$ has no inflection points.

22. $\lim\limits_{x \to 1^-} \left(\dfrac{-2}{x^2 - 1} - \dfrac{1}{|x-1|} \right) = L$

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

(b) ∞

(c) $-\infty$

(d) 0

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

Redefine: $|x-1| = \begin{cases} x-1 : x > \\ 1-x : x < \end{cases}$

$L = \lim\limits_{x \to 1^-} \left(\dfrac{-2}{x^2-1} - \dfrac{1}{1-x} \right)$

$= \lim\limits_{x \to 1^-} \left(\dfrac{-2}{(x-1)(x+1)} + \dfrac{1}{x-1} \right)$

$= \lim\limits_{x \to 1^-} \left(\dfrac{-2 + (x+1)}{(x-1)(x+1)} \right)$

$= \lim\limits_{x \to 1^-} \dfrac{\cancel{x-1}}{\cancel{(x-1)}(x+1)}$

$= \lim\limits_{x \to 1^-} \dfrac{1}{x+1}$

$= \boxed{\dfrac{1}{2}}$

23. If $f(1) = 1$, $f'(1) = -1$, $f''(1) = -2$ and $g(x) = \ln(f(x))$, then $g''(1) =$

(a) -3

(b) 1

(c) 0

(d) 2

(e) 3

$$g'(x) = \frac{1}{f(x)} \cdot f'(x) = \frac{f'(x)}{f(x)}$$

$$g''(x) = \frac{f''(x) \cdot f(x) - f'(x) \cdot f'(x)}{(f(x))^2}$$

$$g''(1) = \frac{f''(1) \cdot f(1) - (f'(1))^2}{(f(1))^2}$$

$$= \frac{(-2)(1) - (-1)^2}{1} = -3$$

24. The slope of the **normal** line to the curve of $f(x) = \sec^2(x)$ at $\left(\frac{\pi}{4}, 2\right)$ is

(a) $\frac{-1}{4}$

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

(c) -4

(d) 4

(e) 2

$$m_{tangent} = f'(\tfrac{\pi}{4})$$

$$f'(x) = 2 \cdot \sec(x) \cdot \sec(x) \cdot \tan x$$

$$= 2 \cdot \sec^2(x) \cdot \tan(x).$$

$$f'(\tfrac{\pi}{4}) = 2 \cdot (2)(1) = 4.$$

$$m_{normal} = \frac{-1}{m_{tangent}}, \quad m_{tangent} \neq 0$$

$$= \boxed{\frac{-1}{4}}$$

25. The curve $f(x) = \frac{2}{\pi}\tan^{-1}(x) + x + 1$ has two slant asymptotes, which are

(a) $y = x + 2$ and $y = x$

(b) $y = x + 1$ and $y = x - 1$

(c) $y = x + 1$ and $y = -x + 1$

(d) $y = -x - 1$ and $y = -x$

(e) $y = x + 2$ and $y = x - 2$

Notice that

$$\lim_{x \to \infty} \frac{2}{\pi}\tan^{-1}(x) = \frac{2}{\pi}\cdot\frac{\pi}{2} = 1$$

So, $\lim_{x\to\infty}\left(f(x) - (x+2)\right) = 0$

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

$= -1$

So, $\lim_{x\to-\infty}\left(f(x) - x\right) = 0$

$\therefore$ $L_1(x) = x + 2$

& $L_2(x) = x$

are slant asymptotes.

26. The minimum distance from the point $(0, 1)$ to the curve $y = x^2$ is

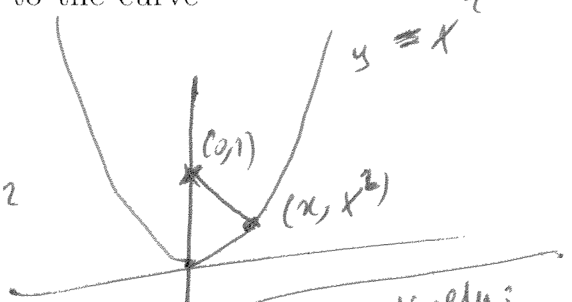
(a) $\frac{\sqrt{3}}{2}$

(b) 1

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

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

(e) 2



$d^2 = (\Delta x)^2 + (\Delta y)^2$

$= (x-0)^2 + (x^2-1)^2$

$= x^2 + x^4 - 2x^2 + 1$

$\boxed{d^2 = x^4 - x^2 + 1}$

alternatively:

$d^2 = u^2 - u + 1$

$(u = x^2)$

The min. is at the vertex of the parab.

$u = \frac{-(-1)}{2} = \frac{1}{2}$

$d^2 = 3/4$

$d = \sqrt{3}/2$

let $f(x) = x^4 - x^2 + 1$.

$f'(x) = 4x^3 - 2x$

$= 2x(2x^2 - 1)$

$f'(x) = 0 \Rightarrow x = 0$ or $x = \mp\frac{1}{\sqrt{2}}$.

$f'(x)$: $- - -$ $-\frac{1}{\sqrt{2}}$ $+ + + + +$ 0 $- - -$ $\frac{1}{\sqrt{2}}$ $+ + + +$

f: $-\frac{1}{\sqrt{2}}$, 0, $\frac{1}{\sqrt{2}}$

$\therefore f\left(\frac{1}{\sqrt{2}}\right) = f\left(-\frac{1}{\sqrt{2}}\right)$

$= \frac{1}{4} - \frac{1}{2} + 1$

$= \frac{3}{4}$ is absolute min.

$d = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2}$

27. Let $f(x) = \dfrac{3 - x^3}{|x|^3 - 3}$, H be the number of horizontal asymptotes and V be the number of vertical asymptotes. Then

Redefine : $|x|^3 = \begin{cases} x^3 ; & x > 0 \\ -x^3 ; & x < 0 \end{cases}$

(a) $H = 2, V = 1$

(b) $H = 1, V = 1$

(c) $H = 1, V = 2$

(d) $H = 0, V = 1$

(e) $H = 2, V = 2$

$f(x) = \begin{cases} \dfrac{3-x^3}{x^3-3} ; & x \geq 0 \\ \dfrac{3-x^3}{-x^3-3} ; & x < 0 \end{cases} = \begin{cases} -1 ; & x > 0 \\ \dfrac{-x^3+3}{-x^3-3} ; & x < 0 \end{cases}$

$\lim_{x \to \infty} f(x) = \lim_{x \to \infty} (-1) = -1$

$\lim_{x \to -\infty} f(x) = \lim_{x \to -\infty} \dfrac{-x^3+3}{-x^3-3} = 1$

$\lim_{x \to -\sqrt[3]{3}^+} \dfrac{-x^3+3}{-x^3-3} = \dfrac{6}{0^-} = -\infty$

$\therefore$ f(x) has 2 horizontal asymptotes & 1 vertical asymptote

28. If $f(x) = \sqrt{x^2 + 7x + 1}$, then

$$\lim_{h \to 0} \frac{f(1+h) - 3}{h} = f'(1)$$

(a) $\dfrac{3}{2}$

(b) 1

(c) 0

(d) 3

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

$f'(x) = \dfrac{2x+7}{2\sqrt{x^2+7x-1}}$

$f'(1) = \dfrac{9}{2(3)} = \dfrac{(3)\cancel{(3)}}{(2)\cancel{(3)}} = \dfrac{3}{2}$