1. $\lim_{t \to 1} \frac{50(t^2+4t)}{t^2+3t+21} =$

$\frac{50\,(1+4)}{1+3+21} = \frac{(50)(5)}{25}$

$= 10$

(a) 10

(b) $\frac{1}{10}$

(c) 2

(d) $\frac{1}{50}$

(e) 50

2. $\lim_{x \to 1} \frac{2x^2+x-3}{x^2+4x-5} =$

$\lim_{x \to 1} \frac{(2x+3)\cancel{(x-1)}}{(x+5)\cancel{(x-1)}}$

$= \frac{2(1)+3}{1+5}$

$= \frac{5}{6}$

(a) $\frac{5}{6}$

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

(c) $\frac{3}{5}$

(d) 2

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

3. Let $f(x) = \dfrac{1}{2x+3}$. Then $\lim\limits_{h\to 0} \dfrac{f(h) - f(0)}{h} =$

$\lim\limits_{h \to 0} \dfrac{f(0+h) - f(0)}{h}$

$= f'(0)$

(a) $-\dfrac{2}{9}$

(b) $-\dfrac{1}{2}$

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

(d) 2

(e) $-\dfrac{2}{3}$

$f'(x) = \dfrac{-2}{(2x+3)^2}$

$= \dfrac{-2}{(0+3)^2} = \dfrac{-2}{9}$

4. $\lim\limits_{x\to\infty} \dfrac{2x^2 - 4x^4 - 3}{x^2 - 3} =$

$\lim\limits_{x \to \infty} \dfrac{-4x^4}{x^2}$

(a) $-\infty$

(b) 2

(c) ∞

(d) -4

(e) 0

$= \lim\limits_{x \to \infty} -4x^2$

$= (-4)(\infty)$

$= -\infty$

5. $\lim_{x \to 2^-} \frac{4}{x-2} =$

$\lim_{u \to 0^-} \frac{4}{u}$ $(u = x-2)$

$= \frac{1}{0^-}$

$= -\infty$

(a) $-\infty$

(b) 4

(c) ∞

(d) 0

(e) -2

6. The set of the value(s) of x for which

$$f(x) = \begin{cases} \frac{1}{x}, & x > 1 \\ 3x-4, & x < 1 \end{cases}$$

is discontinuous is:

$\lim_{x \to 1^-} f(x) = \lim_{x \to 1^-} (3x-4)$

$= 3(1) - 4$

$= -1 \neq$

$\lim_{x \to 1^+} f(x) = \lim_{x \to 1^+} \frac{1}{x} = 1$

(a) $\{1\}$

(b) $\{0, 1\}$

(c) $\{0\}$

(d) $\{\}$

(e) $\{-4\}$

Note $f(0) = -4$ & $f(x)$ is cts. at $x = 0$.

$\therefore \lim_{x \to 1} f(x)$ D.E.

So $f(x)$ is not continuous at $x = 1$

7. The slope of the curve $y = \dfrac{4}{2-x}$ at the point $(3, -4)$ is

(a) 4

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

(c) -2

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

(e) 0

$$m_{\text{tangent}} = y'\Big|_{x=3} = \frac{4\cdot(-1)(-1)}{(2-x)^2}\Big|_{x=3}$$

$$= \frac{+4}{(1)^2}$$

$$= +4$$

8. If $f(x) = \dfrac{x^2 - 3x^{-2/3}}{x}$, then $f'(x) =$

(a) $1 + 5x^{-8/3}$

(b) $2x + 2x^{-5/3}$

(c) $\dfrac{3x^2 + 2x^{-5/3} - 3x^{-3/2}}{x^2}$

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

(e) 0

$$f(x) = x - 3x^{-\frac{5}{3}}.$$

$$f'(x) = 1 - 3\cdot\left(-\frac{5}{3}\right)x^{-\frac{8}{3}}$$

$$= 1 + 5x^{-\frac{8}{3}}.$$

9. An equation of the tangent line to the curve $y = 4x^2 - 6x - 5$ at the point $(-1, 5)$ is

(a) $y = -14x - 9$

(b) $y = 8x - 6$

(c) $y = (8x - 6)(x - 1) + 5$

(d) $y = 14x + 71$

(e) $y = -14x + 19$

$y' = 8x - 6$

$m_{\text{tangent}} = y'\Big|_{x=-1} = 8(-1) - 6 = -14$

$y - y_0 = m(x - x_0)$

$y - 5 = -14(x - (-1))$

$y = -14x - 14 + 5$

$y = -14x - 9$

10. The average cost $\bar{c}$ for producing q units of a product is given by $\bar{c} = 0.01q^2 + 11 + \frac{1000}{q}$. The marginal cost when $q = 10$ is

(a) 14

(b) 82.4

(c) 12

(d) 1120

(e) 112

$c(x) = q\,\bar{c}(q)$

$= 0.01q^3 + 11q + 1000$

marginal cost $= c'(q)$

$= 0.03q^2 + 11$

$c'(10) = (0.03)(10)^2 + 11$

$= 3 + 11$

$= 14$

11. If $f(x) = \dfrac{x^2 - 1}{x^3 + x + 1}$, then $f'(1) =$

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

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

(c) 1

(d) 2

(e) 0

Using the quotient rule:

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

$$f'(1) = \frac{2(3) - 0}{(3)^2}$$

$$= \frac{6}{9}$$

$$= \frac{2}{3}$$

12. Let $f(x) = x^2 g(x)$. If $g(1) = 2$ and $g'(1) = 2$, then $f'(1) =$

(a) 6

(b) 4

(c) 2

(d) 1

(e) 0

$$f'(x) = 2x \cdot g(x) + x^2 \cdot g'(x)$$

$$f'(1) = 2 \cdot g(1) + 1 \cdot g'(1)$$

$$= (2)(2) + 2$$

$$= 6$$

13. The cost c of producing q units of a product is given by

$$c = 5500 + 12q + 0.2q^2$$

and the price per unit p is given by the equation

$$q = 900 - 1.5p.$$

Using the chain rule, the rate of change of cost with respect to the price per unit when $p = 100$ is

(a) -468

(b) 512

(c) -400

(d) 320

(e) -424

$$\frac{dc}{dp} = \frac{dc}{dq} \cdot \frac{dq}{dp}$$

$$= (12 + 0.4q) \cdot (-1.5)$$

When $p = 100$, $q = 900 - (1.5)(100)$
$= 900 - 150 = 750$.

$$\left.\frac{dc}{dp}\right|_{\substack{p=100 \\ q=750}} = (12 + (0.4)(750))(-1.5)$$
$$= (312)(-1.5)$$
$$= -468$$

14. Let $f(x) = (x + g(x))^3$. If $g(1) = 1$ and $g'(1) = -1$, then $f'(1) =$

(a) 0

(b) 3

(c) 6

(d) 2

(e) 24

$$f'(x) = 3(x + g(x))^2 \cdot (1 + g'(x))$$

$$f'(1) = 3(1 + g(1))^2 \cdot (1 + g'(1))$$

$$= 3(1 + 1)^2 \cdot (1 - 1)$$

$$= 0$$

15. The slope of the tangent line of $y = \ln(x^2 - 3x - 3)$ at $x = 4$ is:

(a) 5

(b) -5

(c) 1

(d) -1

(e) 0

$$y' = \frac{2x-3}{(x^2-3x-3)}$$

$$y'\Big|_{x=4} = \frac{2(4)-3}{(16-12-3)} = \frac{5}{1} = 5$$

16. Let $f(x) = e^{\pi} + e^{3x} + 3^{-x}$. Then $f'(0) =$

(a) $3 - \ln 3$

(b) $3 + \ln 3$

(c) $e^{\pi} + 3 - \ln 3$

(d) $e^{\pi} + 3 + \ln 3$

(e) $e + \ln 3$

$$f'(x) = 0 + 3e^{3x} + 3^{-x}\cdot(\ln 3)(-1)$$

$$= 3e^{3x} - (\ln 3)\, 3^{-x}.$$

$$f'(0) = 3 - \ln 3.$$

17. After t years, the value S of a principal P dollars invested at the annual rate of r compounded continuously is given by $S = Pe^{rt}$. The relative rate of change of S with respect to t is

(a) r

(b) Pr

(c) P

(d) $2r$

(e) $2P$

$S'(t) = dS/dt = Pe^{rt}(r)$

Relative rate of change $= \frac{S'(t)}{S(t)}$

$= \frac{r\cancel{Pe^{rt}}}{\cancel{Pe^{rt}}}$

$= r$

18. A country's savings S is defined implicitly in terms of its national income I by the equation

$$S^2 + \frac{1}{4}I^2 = SI + I$$

where both S and I are in billions of dollars. The marginal propensity to consume with $I = 16$ and $S = 12$ is

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

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

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

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

(e) $\frac{7}{8}$

$2S \cdot \frac{dS}{dI} + \frac{I}{2} = \frac{dS}{dI} \cdot I + S + 1$

$\frac{dS}{dI}(2S - I) = S + 1 - \frac{I}{2}$.

$\left.\frac{dS}{dI}\right|_{\substack{S=12 \\ I=16}} = \frac{12+1-8}{2(12)-16} = \frac{5}{8}$.

$\frac{dC}{dI} = 1 - \frac{dS}{dI} = 1 - \frac{5}{8}$.

$= \frac{3}{8}$

19. If $y = (2x-1)^{3x}$, then $y'(1) =$

(a) 6

(b) -6

(c) $3\ln(2)$

(d) $6\ln(3)$

(e) 3

$\ln y = 3x \cdot \ln(2x-1)$

$\frac{y'}{y} = 3 \cdot \ln(2x-1) + 3x \cdot \frac{(2)}{2x-1}$

At $x=1$, $y=1$.

$\frac{y'|_{x=1}}{1} = 3\ln(1) + \frac{(3)(2)}{1}$

$= 0 + 6 = 6.$

20. If $c = 0.2q^2 + 2q + 500$ is a cost function, the rate of change of the marginal cost when $q = 100$ is

(a) 0.4

(b) 0.04

(c) 4

(d) 42

(e) 40

$c'(q) = 0.4q + 2.$

$c''(q) = 0.4$

$c''(100) = 0.4.$

Answer KEY

Q	MM	V1	V2	V3	V4
1	a	c	c	d	c
2	a	c	c	a	d
3	a	b	c	d	d
4	a	e	c	d	a
5	a	d	a	a	d
6	a	b	e	c	b
7	a	c	b	c	d
8	a	a	e	c	d
9	a	e	a	b	a
10	a	c	d	d	a
11	a	a	e	d	d
12	a	e	b	d	b
13	a	b	d	a	a
14	a	a	b	a	a
15	a	a	e	c	b
16	a	c	b	b	b
17	a	d	a	c	b
18	a	d	b	c	a
19	a	b	e	b	c
20	a	d	d	a	a