`Chapter 5: Practice/review problems`

The collection of problems listed below contains questions taken from previous MA123 exams.

Derivatives

[1]. If $f(x) = 6x^2 + 3x - 1$, find $f'(x)$.

(a) $6x + 1$ **(b)** $12x + 3$ **(c)** $12x - 1$ **(d)** $2x + 3$ **(e)** $2x + 5$

[2]. If $f(x) = x^3 + 4x^2 + 2x + 1$ then $f'(x) =$

(a) $3x^2 + 8x + 3$ **(b)** $x^2 + x + 1$ **(c)** $3x^2 + 8x + 2$

(d) $3x^2 + 8x + 1$ **(e)** $3x^2 + 4x + 1$

[3]. If $f(x) = x^3$ then

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

(**Hint:** Relate the limit to the derivative of $f(x)$.)

(a) 0 **(b)** 1 **(c)** 2 **(d)** 3 **(e)** 4

[4]. Suppose $f(t) = t^3 - t^2 + t + 1$. Find the limit

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

(**Hint:** Relate the limit to the derivative.)

(a) -1 **(b)** 0 **(c)** 1 **(d)** 2 **(e)** The limit does not exist

[5]. If $Q(s) = s^7 + 1$, find

$$\lim_{h \to 0} \frac{Q(1+h) - Q(1)}{h}$$

(a) 2 **(b)** 5 **(c)** 6 **(d)** 7 **(e)** 8

[6]. If $f(x) = |x - 1|$ find $\lim_{h \to 0} \frac{f(1+h) - f(1)}{h}$

(a) 3 **(b)** -3 **(c)** 1 **(d)** -1 **(e)** Does not exist

[7]. Let $f(x) = x\,|x| - x$. Find the derivative, $f'(0)$, by evaluating the limit

$$\lim_{h \to 0} \frac{f(h) - f(0)}{h}$$

(a) -2 **(b)** -1 **(c)** 0 **(d)** 1 **(e)** Does not exist

[8]. Let $[\![x]\!]$ denote the greatest integer function. Recall the definition:

$$[\![x]\!] \text{ equals the greatest integer less than or equal to } x\ .$$

How many points are there in the interval $(1/2, 9/2)$ where the derivative of $[\![x]\!]$ is not defined?

(a) 1 **(b)** 2 **(c)** 3 **(d)** 4 **(e)** 5

The product rule

[9]. Suppose that $h(x) = f(x)g(x)$. Assume that $f(2) = 3$, $f'(2) = -2$, $g(2) = 1$, and $g'(2) = 5$. Find $h'(2)$.

(a) -20 **(b)** -17 **(c)** 11 **(d)** 13 **(e)** Cannot be determined

[10]. If $h(t) = (t-1)(t+1)(t^2+1)$ then $h'(2)$ equals

(a) 0 **(b)** 4 **(c)** 8 **(d)** 16 **(e)** 32

[11]. Let $k(x) = (x+3)(x+4)(x+1)$. Find $k'(x)$.

(a) 12 **(b)** $3x^2 + 16x + 19$ **(c)** $3x^2 + 18x + 20$

(d) $3x^2 + 14x + 16$ **(e)** 1

[12]. If $R(x) = (x-2)(x^2-2)(x^3-2)$, find $R'(2)$

(a) 0 **(b)** 12 **(c)** 48 **(d)** -8 **(e)** -6

The quotient rule

[13]. If $f(x) = \dfrac{x-1}{x+1}$ then $f'(x) =$

(a) $\dfrac{2}{x^2+1}$ **(b)** $\dfrac{2}{(x+1)^2}$ **(c)** $\dfrac{-2}{(x+1)^2}$ **(d)** $\dfrac{-2}{x^2+1}$ **(e)** $\dfrac{-2}{(x-1)^2}$

[14]. Suppose that $f(x) = \dfrac{x^2+1}{x+4}$. Find $f'(-3)$.

(a) -8 **(b)** -9 **(c)** -10 **(d)** -14 **(e)** -16

[15]. Find $Y'(s)$ if $Y(s) = \dfrac{1}{4s^2} - \dfrac{5}{s}$.

(a) $\dfrac{5}{2}s^{-3} + s^{-2}$ **(b)** $-\dfrac{1}{2}s^{-3} + 5s^{-2}$ **(c)** $-\dfrac{2}{5}s^{-3} + s^{-2}$

(d) $\dfrac{1}{2}s^{-3} + 5s^{-2}$ **(e)** $-2s^{-3} - 3s^{-2}$

[16]. If $F(t) = \dfrac{3t+1}{t-1}$ then $F'(t) =$

(a) $-4/(t-1)^2$ **(b)** $-4/(3t+1)^2$ **(c)** $-2/(t-1)^2$ **(d)** $-3/(t-1)^2$ **(e)** $-2/(t-1)$

[17]. Let $T(x) = \dfrac{g(x)}{f(x)}$. If $f(2) = 3$, $f'(2) = 4$, $g(2) = 5$, and $g'(2) = 6$, find $T'(2)$.

(a) $\dfrac{38}{9}$ **(b)** $\dfrac{38}{25}$ **(c)** $\dfrac{2}{25}$ **(d)** $-\dfrac{2}{9}$ **(e)** 38

[18]. Evaluate the derivative, $H'(1)$ if

$$H(s) = \frac{2s}{s+1}$$

(a) 2/9 **(b)** 4/9 **(c)** 1/2 **(d)** 3/2 **(e)** 8/9

[19]. Suppose the cost, $C(q)$, of stocking a quantity q of a product equals

$$C(q) = 12 + 3q + \frac{8}{q}.$$

The rate of change of the cost with respect to q is called the marginal cost. What is the marginal cost when the cost equals 23 and the cost is decreasing?

(a) -5 **(b)** -1 **(c)** 0 **(d)** 1 **(e)** 5

[20]. Suppose the cost, $C(q)$, of stocking a quantity q of a product equals

$$C(q) = \frac{100}{q} + q$$

For which positive value of q is the tangent line to the graph of $C(q)$ a horizontal line?

(a) 1/100 **(b)** 1/10 **(c)** 1 **(d)** 10 **(e)** 100

[21]. Suppose $u(t)$ and $w(t)$ are differentiable for all t and the following values of the functions and derivatives are known: $u(7) = 2$, $u'(7) = -1$, $w(7) = 1$, and $w'(7) = 9$. Find the value of $h'(7)$ when

$$h(t) = \frac{w(t)+5}{u(t)}.$$

(a) 3 **(b)** 6 **(c)** -3 **(d)** 12 **(e)** -6

[22]. Suppose $f(t) = \dfrac{F(t)}{t}$ and $F(1) = 2$, $F'(1) = 6$. Find $f'(1)$.

(a) 2 **(b)** 4 **(c)** 1 **(d)** -4 **(e)** -1