Differentiation Exercises

1. Differentiate with respect to x:
   (a) x^3

   (b) x^{10}

   (c) x^{-6}

   (d) $x^{4^1/_2}$

   (e) $7x^4$

   (f) $2x^{-3}$

   (g). $8x^{1/_2}$

   (h) $7x^5 + 2$

   (i) $x^2 + 3x$

   (j) $4x^6 - x^{-3}$

   (k) $x^2 + 3x - 5$

   (l) $6x^4 + 4x^2 + x$

   (m) $\dfrac{x^{3/4}}{5} + 2x^{5/_3}$

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

   (o) $x^{-1} + x^{-1/_2}$

2. Find the derivative of each of the following:
   a. $2x^2 + x + 4$

   b. $(x + 1)(x - 1)$

   c. $3x(x^2 + 1)$

   d. $4x^2 + \dfrac{1}{x}$

   e. $\dfrac{5x^2 - 7x}{x}$

   f. $5 + x - \sqrt{x}$

   g. $7\sqrt{x} + \sqrt[3]{x^2}$

   i. $3x^3(x^{-2} + 4x - 2x^{1/_2})$

   h. $\dfrac{4}{5x^2} + 3x^3 - 2$

   j. $\dfrac{(2x-3)(x+4)}{x^2}$

3. If $y = 2x^3 + 3x^2 - 4$, find:
   a. $\dfrac{dy}{dx}$

   b. $\dfrac{dy}{dx}$ when $x = 2$

4. If $f(x) = x^2 + 3x - 5$, find:
   a. $f'(x)$

   b. $f'(x)$ when $x = 2$

5. If $g(x) = 5x^2 + 2x$, find:
   a. $g'(3)$

   b. The gradient when $x = -2$

6. $f(x) = x^4 + x^2$. Show that the function is horizontal at the origin.

7. Find the value of x for which the gradient of $f(x) = x^2 - 2x + 1$ is 4.

8. If $g(x) = 4x^2 + 3x$, find the point at which $g'(x) = 7$.

Answers

1. *a*. $3x^2$, *b*. $10x^9$, *c*. $-6x^{-7}$, *d*. $4\frac{1}{2}x^{3^1/_2}$, *e*. $28x^3$, *f*. $-6x^{-4}$, *g*. $4x^{-1/_2}$,

    h. $35x^4$, *i*. $2x+3$, *j*. $24x^5+3x^{-4}$, *k*. $2x+3$, *l*. $24x^3+8x+1$,

    m. $\frac{3}{20}x^{-1/_4}+\frac{10}{3}x^{2/_3}$ *n*. $2x-1$ *o*. $-x^{-2}-\frac{1}{2}x^{-3/_2}$

2. *a*. $4x+1$ *b*. $2x$ *c*. $9x^2+3$ *d*. $8x-x^{-2}$ *e*. 5 *f*. $1-\frac{1}{2}x^{-1/_2}$

    g. $\frac{7}{2}x^{-1/_2}+\frac{2}{3}x^{-1/_3}$, *h*. $\frac{-8}{5}x^{-3}+9x^2$, *i*. $3+48x^3-21x^{2^1/_2}$, *j*. $-5x^{-2}+24x^{-3}$,

3. *a*. $6x^2+6x$,   *b*. 36,

4. *a*. $2x+3$,   *b*. 7

5. *a*. 32,   *b*. -18,

6. $f'(0)=0$,

7. $x=3$,

8. $\left(\frac{1}{2},2\frac{1}{2}\right)$