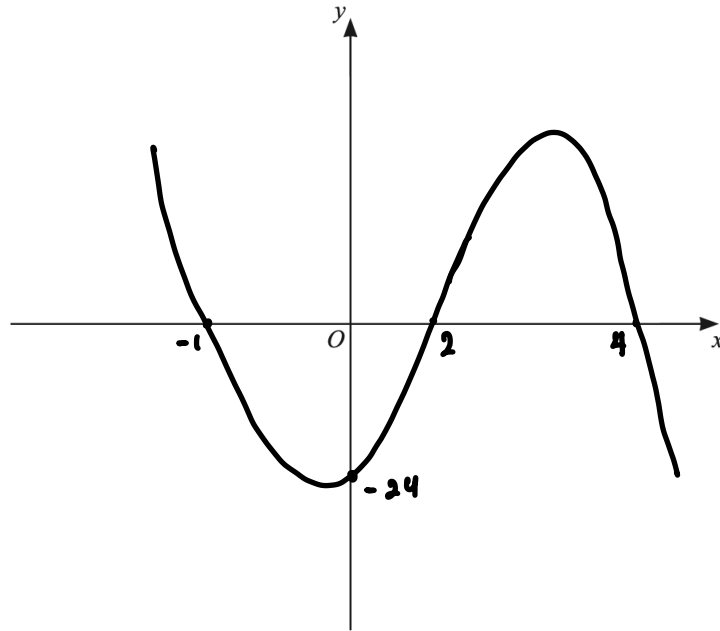


## Chapter (5) Equations, inequality and graphs

1. (a) On the axes below, sketch the graph of  $y = -3(x - 2)(x - 4)(x + 1)$ , showing the coordinates of the points where the curve intersects the coordinate axes.

$$x=0, y = -3x - 2x - 4x1 \\ = -24$$

[3]

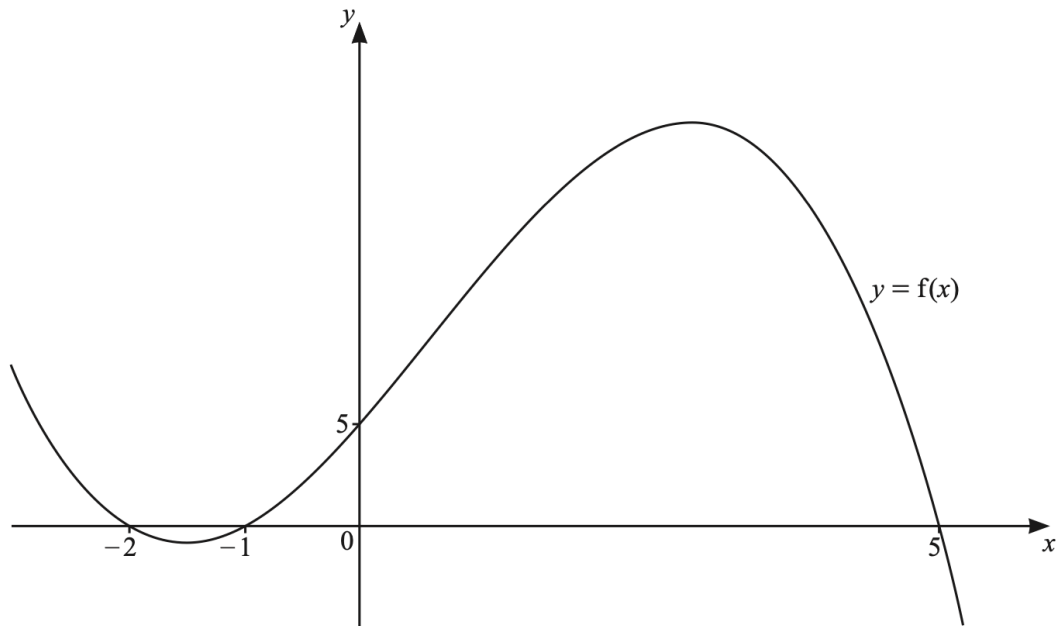


- (b) Hence find the values of  $x$  for which  $-3(x - 2)(x - 4)(x + 1) > 0$ .

$$x < -1 \quad 2 < x < 4$$

[2]

2. The diagram shows the graph of a cubic curve  $y = f(x)$ .



(a) Find an expression for  $f(x)$ .

$$f(x) = -\frac{1}{2}(x+2)(x+1)(x-5)$$

[2]

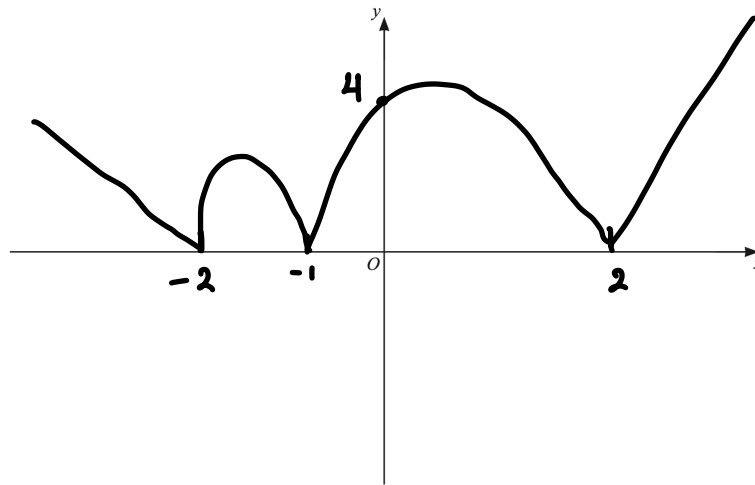
(b) Solve  $f(x) \leq 0$ .

$$-2 \leq x \leq -1, \quad x \geq 5$$

[2]

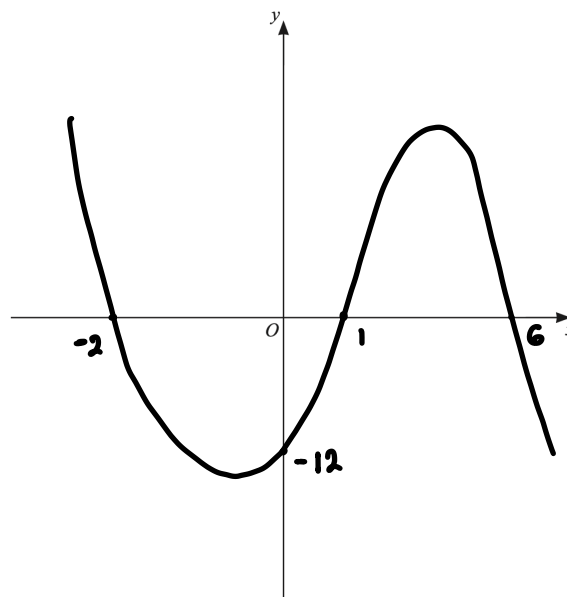
3. On the axes below, sketch the graph of  $y = |(x - 2)(x + 1)(x + 2)|$  showing the coordinates of the points where the curve meets the axes.

[3]



4. (a) On the axes below, sketch the graph of  $y = -(x + 2)(x - 1)(x - 6)$ , showing the coordinates of the points where the graph meets the coordinate axes.

[2]

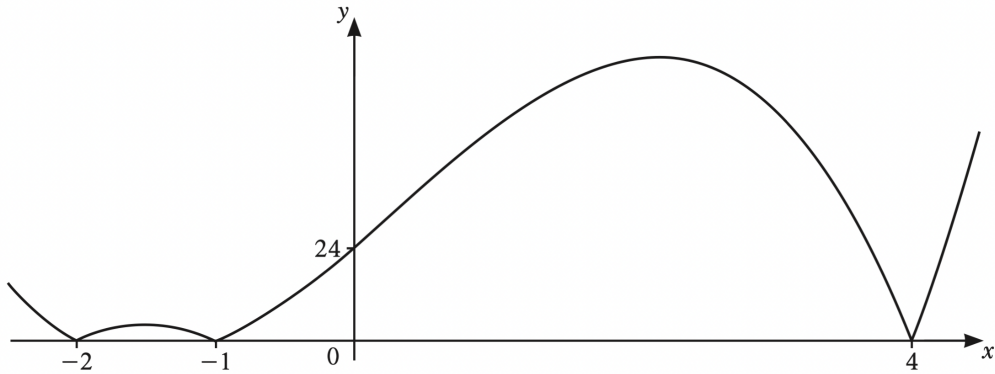


(b) Hence solve  $-(x + 2)(x - 1)(x - 6) \leq 0$ .

[2]

$$-2 \leq x \leq 1, x \geq 6$$

5.

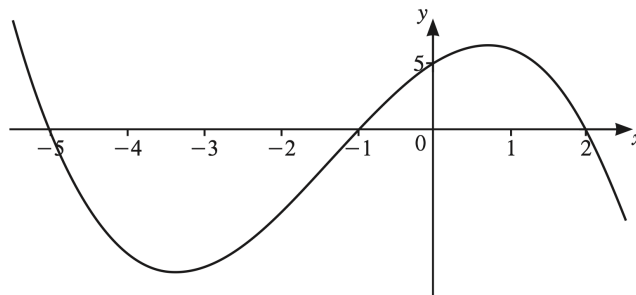


The diagram shows the graph of  $y = |p(x)|$  where  $p(x)$  is a cubic function. Find the two possible expressions for  $p(x)$ .

$$y = \pm 3(x+2)(x+1)(x-4)$$

[3]

6.



The diagram shows the graph of  $y = f(x)$ , where  $f(x)$  is a cubic polynomial.

(a) Find  $f(x)$ .

$$f(x) = -\frac{1}{2}(x+5)(x+1)(x-2)$$

[3]

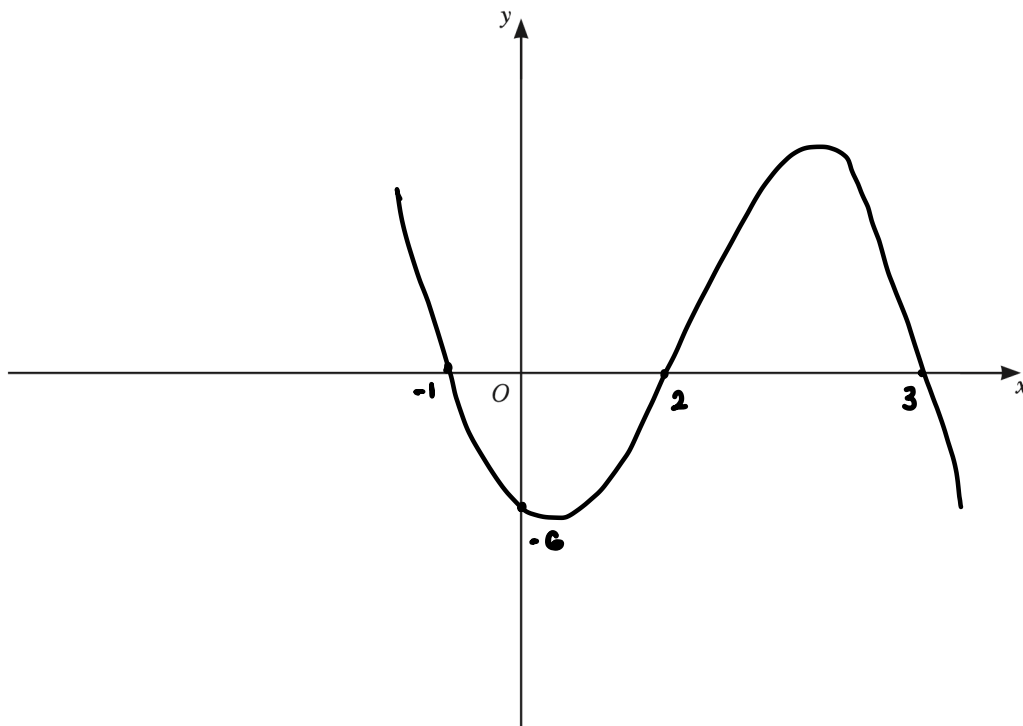
(b) Write down the values of  $x$  such that  $f(x) < 0$ .

$$-5 < x < -1, \quad x > 2$$

[2]

7.(a) On the axes below, sketch the graph of  $y = (x - 2)(x + 1)(3 - x)$  stating the intercepts on the coordinate axes.

[3]

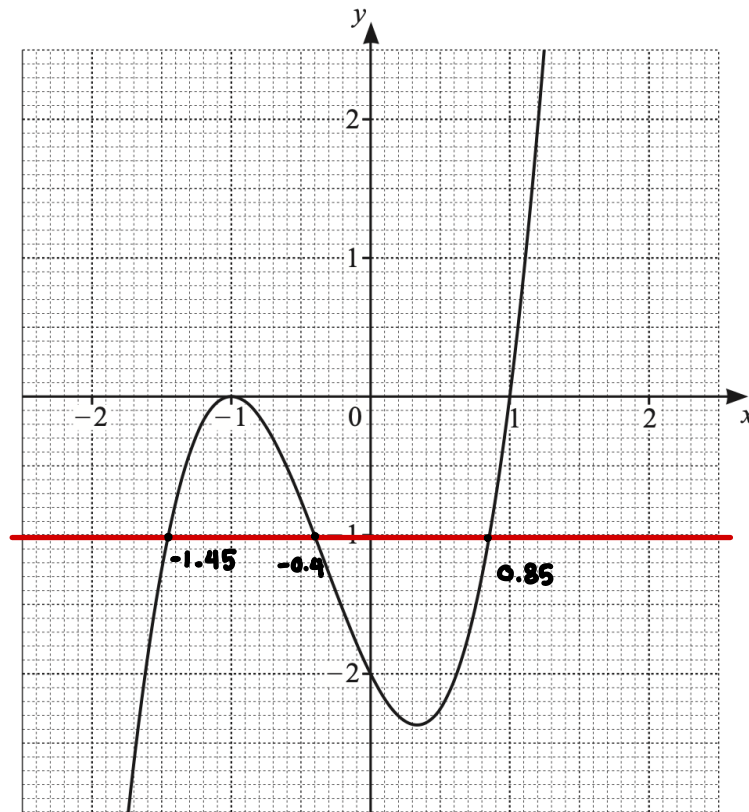


(b) Hence write down the values of  $x$  such that  $(x - 2)(x + 1)(3 - x) > 0$ .

$$x < -1, \quad 2 < x < 3$$

[2]

8.



The diagram shows the graph of  $y = f(x)$ , where  $f(x) = a(x + b)^2(x + c)$  and  $a$ ,  $b$  and  $c$  are integers.

(a) Find the value of each of  $a$ ,  $b$  and  $c$ .

[2]

$$a=2, b=1, c=-1$$

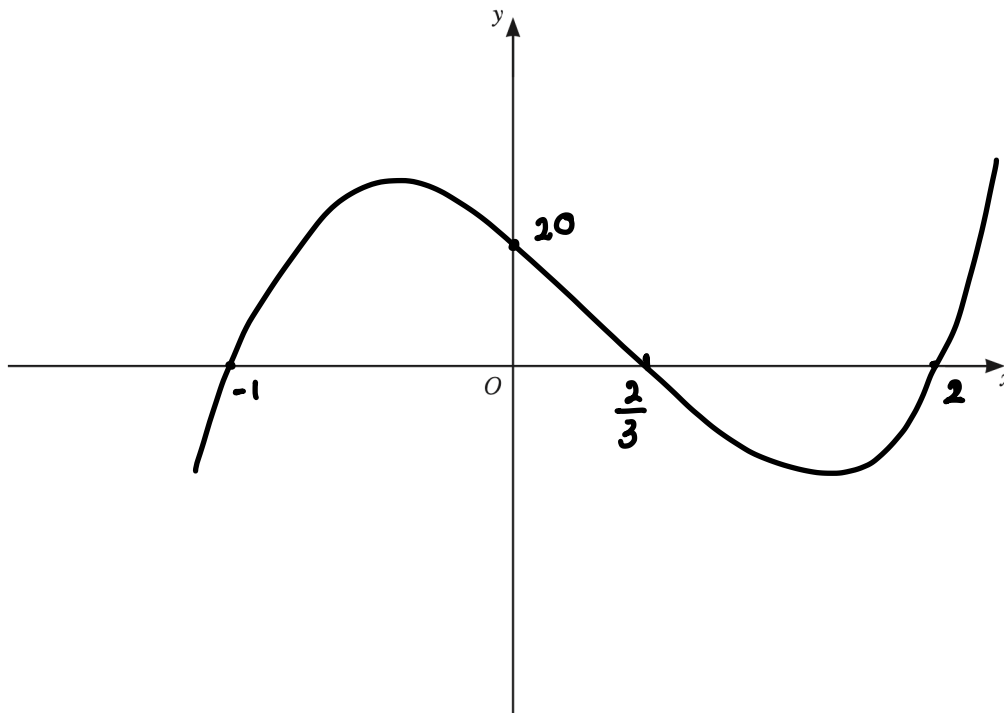
(b) Hence solve the inequality  $f(x) \leq -1$ .

[3]

$$x \leq -1.45$$
$$-0.4 \leq x \leq 0.85$$

9. (a) On the axes, sketch the graph of  $y = 5(x + 1)(3x - 2)(x - 2)$ , stating the intercepts with the coordinate axes.

[3]



(b) Hence find the values of  $x$  for which  $5(x + 1)(3x - 2)(x - 2) > 0$ .

$$-1 < x < \frac{2}{3} \quad x > 2$$

[2]

10. The three roots of  $p(x) = 0$  where  $p(x) = 5x^3 + ax^2 + bx - 2$  are  $x = \frac{1}{5}$ ,  $x = n$  and  $x = n + 1$ , where  $a$  and  $b$  are positive integers and  $n$  is a negative integer. Find  $p(x)$ , simplifying your coefficients.

$$(5x-1)(x-n)(x-n-1)$$

[5]

$$-n^2 - n = -2$$

$$n^2 + n - 2 = 0$$

$$(n+2)(n-1) = 0$$

$$n = -2 \text{ or } n = 1$$

(reject)

$$\begin{array}{r} + \\ \times \\ - \end{array} \begin{array}{r} 2 \\ 1 \end{array}$$

$$(5x-1)(x+2)(x+2-1)$$

$$= (5x-1)(x+2)(x+1)$$

$$= (5x^2 + 10x - x - 2)(x+1)$$

$$= (5x^2 + 9x - 2)(x+1)$$

$$= 5x^3 + 5x^2 + 9x^2 + 9x - 2x - 2$$

$$= 5x^3 + 14x^2 + 7x - 2$$

$$5x^3 + ax^2 + bx - 2$$

$$a = 14, b = 7$$