

1.	X	y = f(x)
	-2	-18
+1 <	-1	-13
+1 <	0	-8
+1 <	1	-3
+1 <	2	2

It is linear

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{-13 - (-18)}{-1 - (-2)} = \frac{5}{1} = 5$$

2	X	y = f(x)
	-2	11
1 <	-1	8
1 <	0	5
1 <	1	1
1 <	2	-2

It is not linear

$$3. f(x) = -2x^2 + 5x + 4$$

$$a = -2, b = 5$$

$$h = \frac{-b}{2a} = \frac{-5}{2(-2)} = \frac{5}{4}$$

$$k = f\left(\frac{5}{4}\right) = -2\left(\frac{5}{4}\right)^2 + 5\left(\frac{5}{4}\right) + 4$$

$$= \frac{57}{8}$$

$$\text{Vertex} = (h, k) = \left(\frac{5}{4}, \frac{57}{8}\right)$$

$$4. f(x) = -4x^2 + 8x$$

$$h = \frac{-b}{2a} = \frac{-8}{2(-4)} = \frac{8}{8} = 1$$

$$f(1) = -4(1)^2 + 8(1) = 4$$

$$\text{Vertex} = (1, 4)$$

$$5. g(x) = 5x^2 - 2x + 1$$

$$h = \frac{-b}{2a} = \frac{-(-2)}{2(5)} = \frac{1}{5}$$

$$f\left(\frac{1}{5}\right) = 5\left(\frac{1}{5}\right)^2 - 2\left(\frac{1}{5}\right) + 1 = \frac{4}{5}$$

$$\text{Vertex} = \left(\frac{1}{5}, \frac{4}{5}\right)$$

$$6. f(x) = -x^2 - 3x - 2$$

$$h = \frac{-b}{2a} = \frac{-(-3)}{2(-1)} = \frac{-3}{2} = -1.5$$

$$k = f\left(-\frac{3}{2}\right) = -\left(-\frac{3}{2}\right)^2 - 3\left(-\frac{3}{2}\right) - 2$$

$$= \frac{1}{4} = 0.25$$

$$\text{Vertex} = (-1.5, 0.25)$$

X-intercept(s)

$$-x^2 - 3x - 2 = 0$$

$$x^2 + 3x + 2 = 0$$

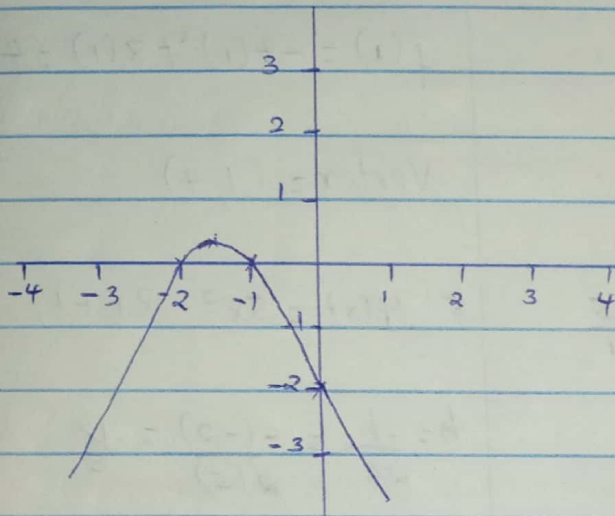
$$(x+1)(x+2) = 0$$

$$x = -1, x = -2$$

$$= (-1, 0), (-2, 0)$$

y-intercept

$$y = f(0) = -(0)^2 - 3(0) - 2 = -2 \\ = (0, -2)$$



Opens downwards

7. $g(x) = 2x^2 - 12x + 7$

$$h = \frac{-b}{2a} = \frac{-(-12)}{2(2)} = 3$$

$$k = g(3) = 2(3)^2 - 12(3) + 7 = -11$$

$$\text{Vertex} = (3, -11)$$

x-intercepts

$$2x^2 - 12x + 7 = 0$$

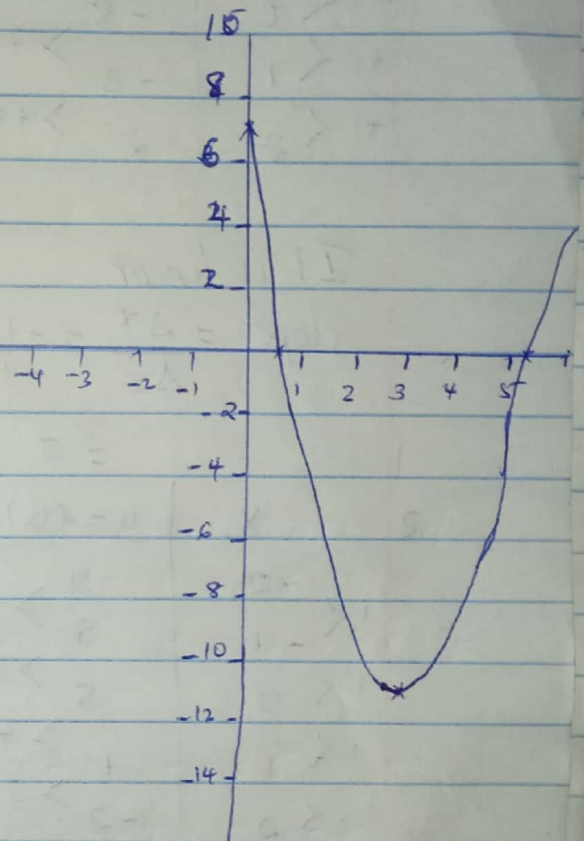
$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{12 \pm \sqrt{144 - 56}}{4} \\ = \frac{12 \pm \sqrt{88}}{4} = 3 \pm \frac{1}{2}\sqrt{22}$$

$$x_1 = \left(3 + \frac{\sqrt{22}}{2}, 0\right)$$

$$x_2 = \left(3 - \frac{\sqrt{22}}{2}, 0\right)$$

y-intercept

$$g(0) = 2(0)^2 - 12(0) + 7 = 7 \\ = (0, 7)$$



Opens upwards

8. $f(x) = -x^2 + 8x + 7$

$$f(x) = ax^2 + bx + c$$

$a = -1$ which is less than 0

The parabola opens downwards, therefore, it has a maximum value

$$x = \frac{-b}{2a} = \frac{-(-8)}{2(-1)} = -4$$

$$f(-4) = -(-4)^2 - 8(-4) + 7 = 23$$

$$\text{Maximum value} = (-4, 23)$$

$$\text{Maximum value} = 23$$

9. $f(x) = 3x^2 - 12x + 5$

$f(x) = ax^2 + bx + c$

$a = 3$ which greater than 0

It has a minimum value

$$x = \frac{-b}{2a} = \frac{-(-12)}{2(3)} = 2$$

$$f(2) = 3(2)^2 - 12(2) + 5 = -7$$

Minimum value = $(2, -7)$

Minimum value = -7

10. Zeros: 0, 4, 1; degree = 3

$$(x-0)(x-4)(x-1) = 0$$

$$x(x-4)(x-1) = 0$$

$$x(x^2 - 5x + 4) = 0$$

$$x^3 - 5x^2 + 4x = 0$$

10 $f(x) = (x-0)(x-4)(x-1)$

$$= x(x^2 - 5x + 4)$$

$$f(x) = x^3 - 5x^2 + 4x$$

11. $f(x) = (x+3)(x-3)(x-4)$

$$= (x^2 - 3x + 3x - 9)(x-4)$$

$$= (x^2 - 9)(x-4)$$

$$f(x) = x^3 - 4x^2 - 9x + 36$$

12. $f(x) = (x+1)^3(x-2)$

(a) $(x+1)^3(x-2) = 0$

$$x = -1, x = 2$$

12. $f(x) = (x+1)^3(x-2)$

(a) $(x+1)^3(x-2) = 0$

$$x = -1, x = 2$$

(b) Multiplicity for $x = -1$ is 3

Multiplicity for $x = 2$ is 1

(c) It crosses the x-axis at $x = 2$

It crosses the x-axis but

flattens out a bit at $x = -1$

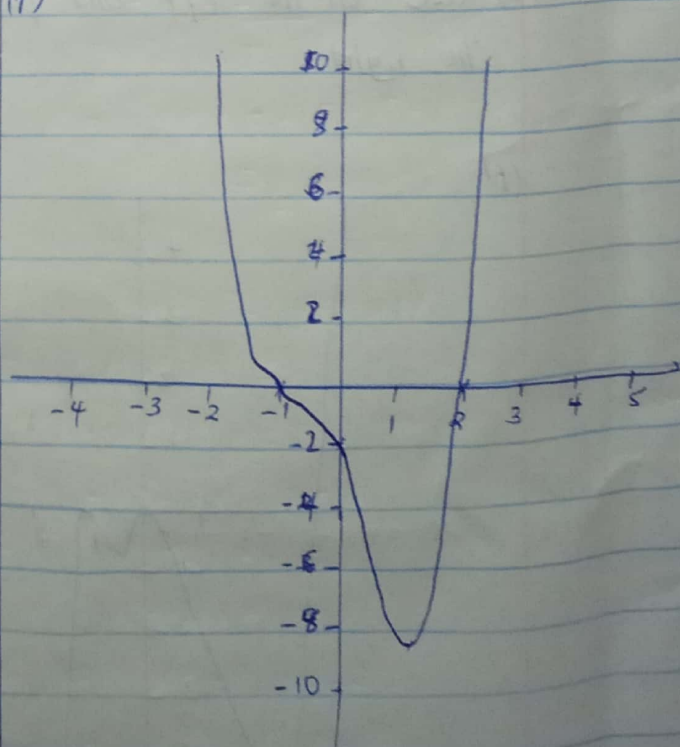
(d) Maximum number of turning points

$$= n - 1$$

$$= 4 - 1 = 3$$

(e) Rises on the left and on the right.

(f)



$$13. f(x) = -2x^2(x-1)^2(x+3)$$

$$(a) -2x^2(x-1)^2(x+3) = 0$$

$$x=0, x=1, x=-3$$

(b) Multiplicity	Real zero
2	0
2	1
1	-3

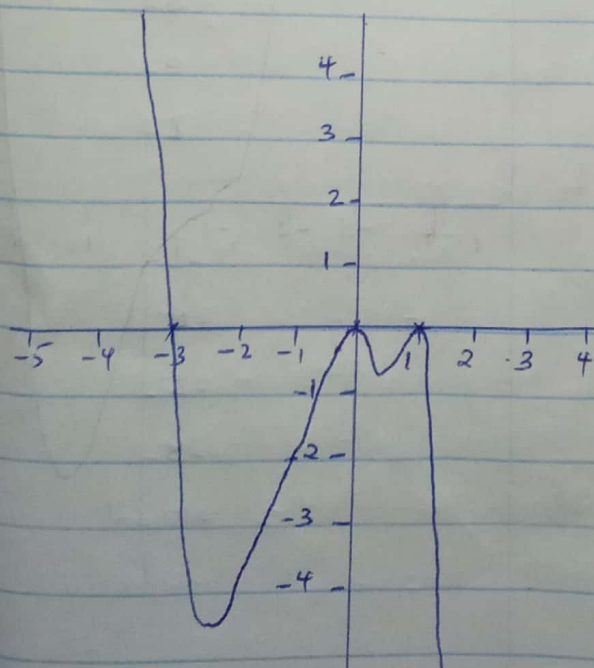
(c) It crosses the x-axis at $x=-3$
It touches the x-axis at $x=0$ and $x=1$

$$(d) n = 2 + 2 + 1 = 5$$

$$\text{Maximum number of turning points} = 5 - 1 = 4$$

(e) Rises on the left and falls on the right

(f)



$$14. f(x) = x(x+2)(x-1)^2(x+1)$$

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

$$x=0, x=-2, x=1, x=-1$$

(b) Multiplicity	Real zero
1	-2
1	-1
2	1
1	0

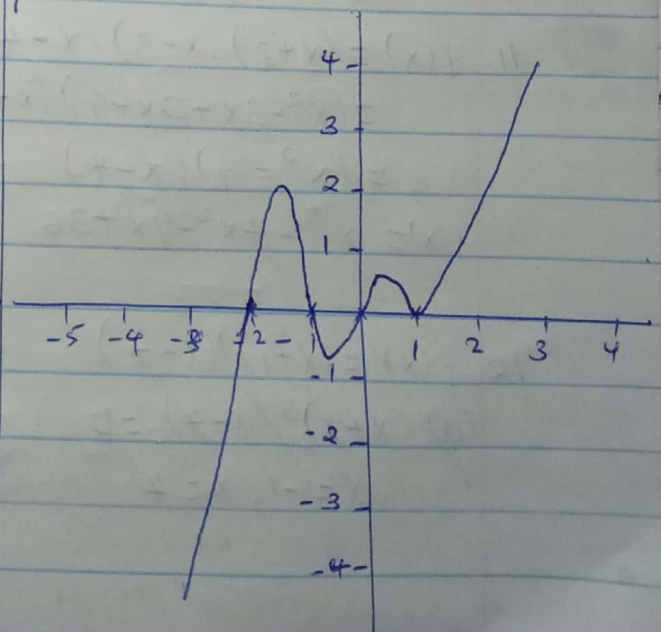
(c) It crosses the x-axis at $x=-2, x=-1$ and $x=0$
It touches x-axis at $x=1$

$$(d) n = 1 + 1 + 2 + 1 = 5$$

$$\text{Turning points} = 5 - 1 = 4$$

(e) Falls on the left and rises on the right

(f)



$$15 \quad f(x) = \frac{x^2 + 11x + 24}{x^2 + 6x - 16}$$

Vertical asymptotes

$$x^2 + 6x - 16 = 0$$

$$(x+8)(x-2) = 0$$

$$x = -8, x = 2$$

Horizontal asymptotes

Since the denominator and numerator

both have the same degree, we will

divide the leading coefficients of the ~~num~~ numerator and denominator

$$y = \frac{1}{1} = 1, y = 1$$

No oblique asymptotes

$$16 \quad f(x) = \frac{x^2 + 14x - 1}{x + 2}$$

Vertical asymptote

$$x + 2 = 0$$

$$x = -2$$

Since the numerator's degree = 1 + denominator's degree, we have oblique asymptote.

We will apply long division

$$\begin{array}{r} x - 16 \\ x + 2 \overline{) x^2 + 14x - 1} \\ \underline{x^2 + 2x} \\ -16x - 1 \\ \underline{-16x - 32} \\ 31 \end{array}$$

oblique asymptote, $y = x - 16$

17.

$$(a) C(x) = 0.14x + 4.79$$

$$(b) C(267) = 0.14(267) + 4.79 \\ = 42.17$$

$$18. f(x) = -\frac{1}{3}x^2 + \frac{4}{3}x$$

$$x = \frac{-b}{2a} = \frac{-\left(\frac{4}{3}\right)}{2\left(-\frac{1}{3}\right)} = \frac{4}{3} \times \frac{3}{2} = 2$$

$$f(2) = -\frac{1}{3}(2)^2 + \frac{4}{3}(2) = \frac{4}{3}$$

Maximum height ~~reig~~ reached
= $\frac{4}{3}$ ft