1. Sketch graphs of all three relations on the same set of axes. Label the x-intercepts, vertex, and axis of symmetry for each parabola. Then, describe the similarities and differences between the graphs.

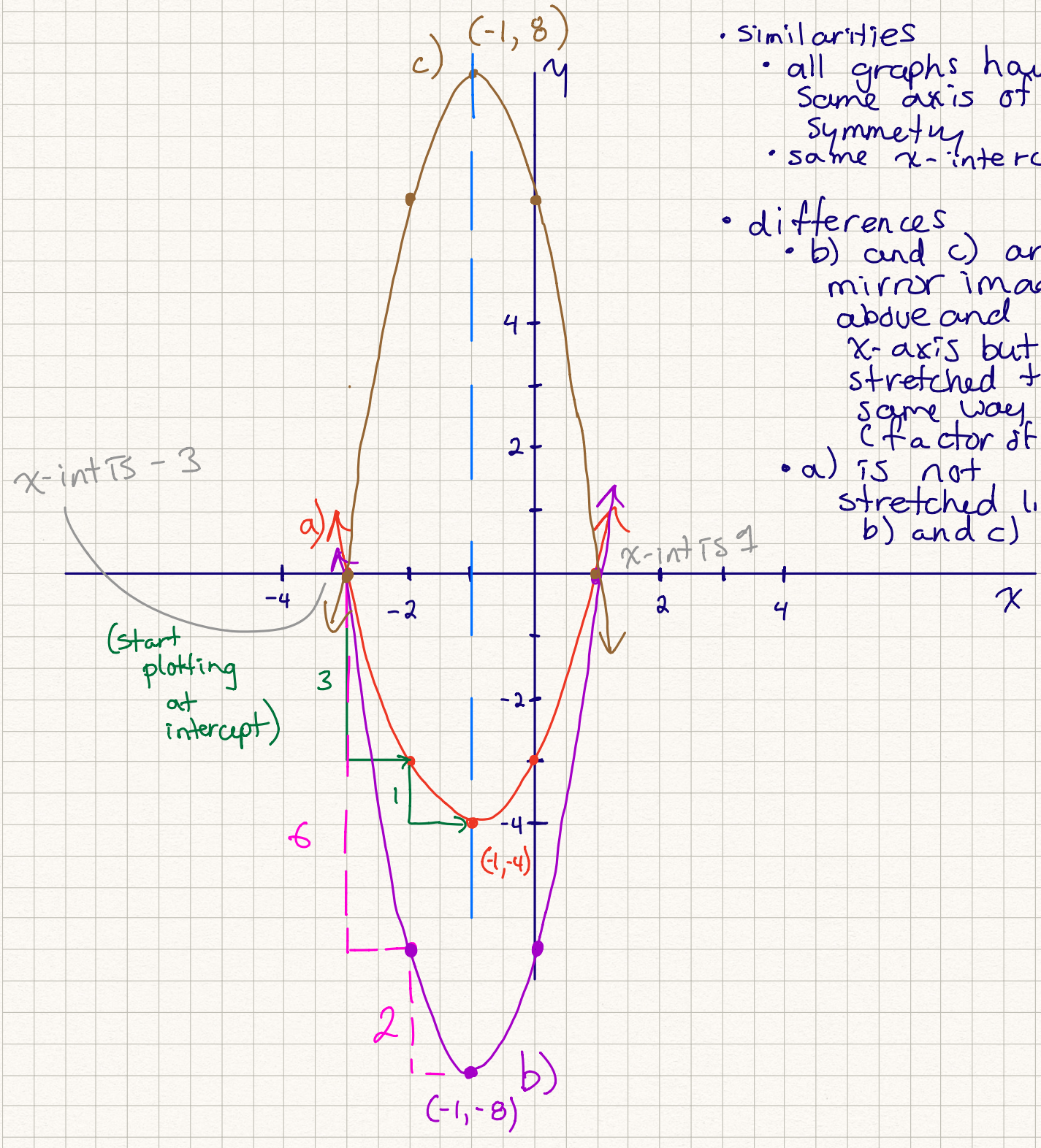
a) $y = (x + 3)(x - 1)$ $a = 1$ so step pattern is 1, 3, 5...

b) $y = 2(x + 3)(x - 1)$ $a = 2$ " " " " 2, 6, 10...

c) $y = -2(x + 3)(x - 1)$ $a = 2$ " " " " 2, 6, 10 (opening down)

$x = -1$ (axis of symmetry for all graphs)

1.



- similarities
  - all graphs have same axis of symmetry
  - same x-intercepts
- differences
  - b) and c) are mirror images above and below x-axis but are stretched the same way (factor of 2)
  - a) is not stretched like b) and c)

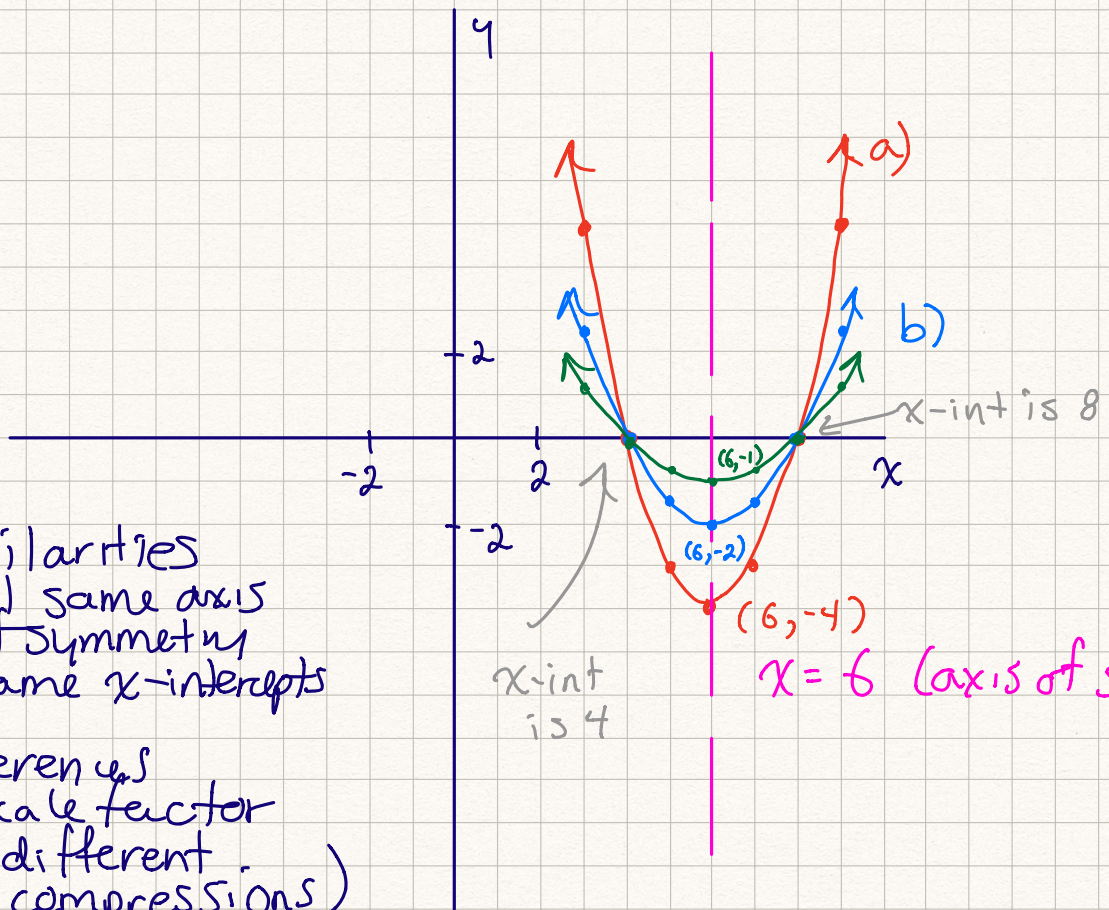
2. Sketch graphs of all three relations on the same set of axes. Label the x-intercepts, vertex, and axis of symmetry for each parabola. Then, describe the similarities and differences between the graphs.

a) $y = (x - 4)(x - 8)$ $a = 1$ so regular step pattern of 1, 3, 5 ...

b) $y = \frac{1}{2}(x - 4)(x - 8)$ $a = \frac{1}{2}$ so step pattern is 0.5, 1.5, 2.5 ...

c) $y = \frac{1}{4}(x - 4)(x - 8)$ $a = \frac{1}{4}$ " " " " 0.25, 0.75, 1.25

2.



- similarities
  - all same axis of symmetry
  - same x-intercepts
- differences
  - scale factor (different compressions)
  - different vertex locations

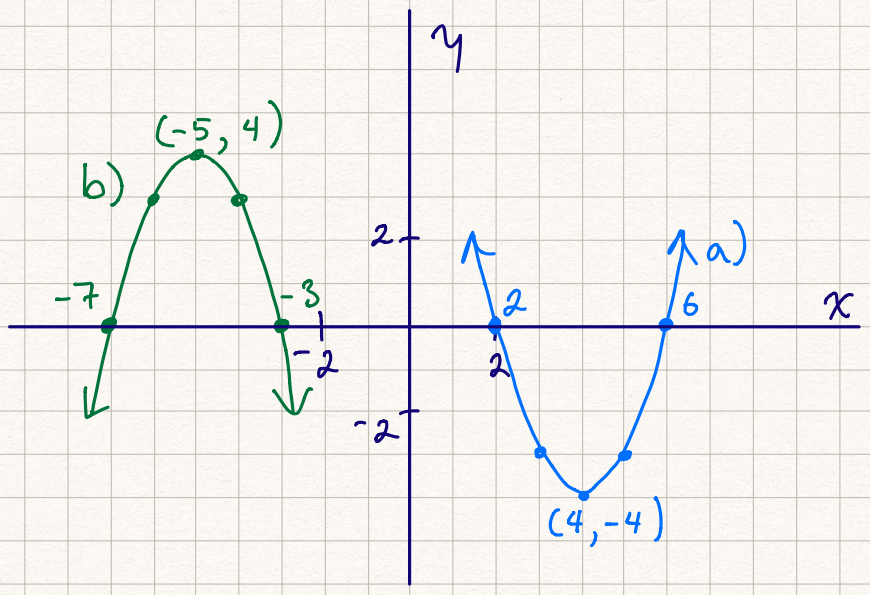
3. Sketch each parabola. Label the x-intercepts and vertex.

a) $y = (x - 6)(x - 2)$

b) $y = -(x + 3)(x + 7)$

c) $y = 2(x - 3)(x + 2)$

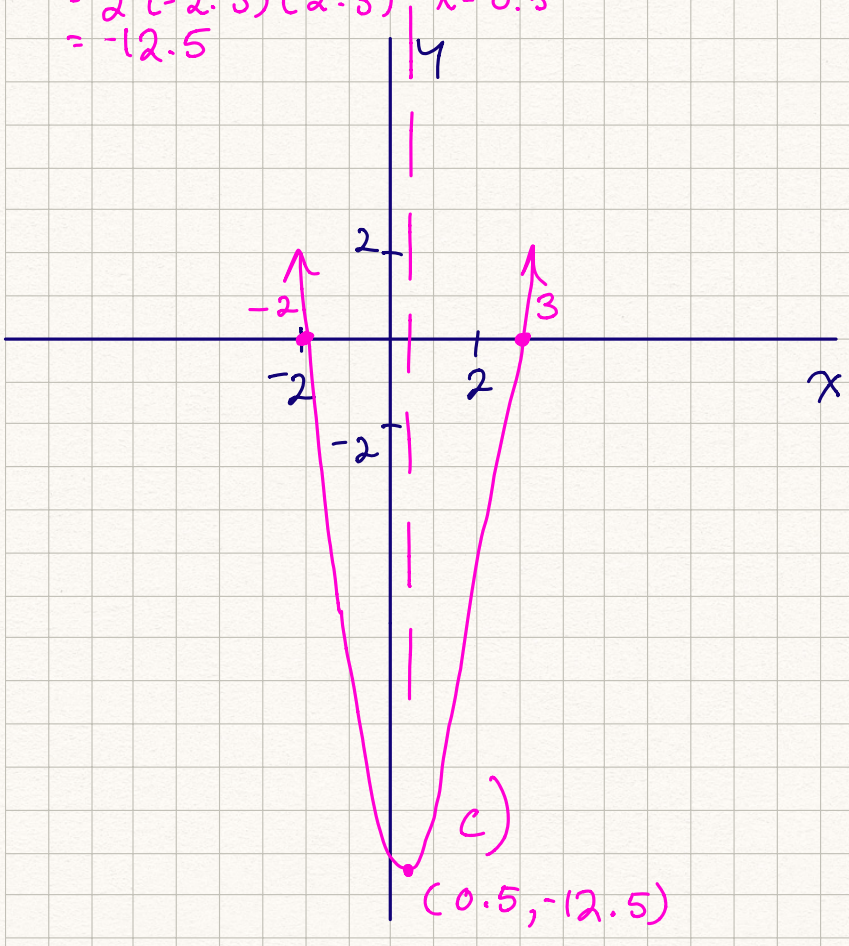
d) $y = -2(x - 4)(x + 2)$

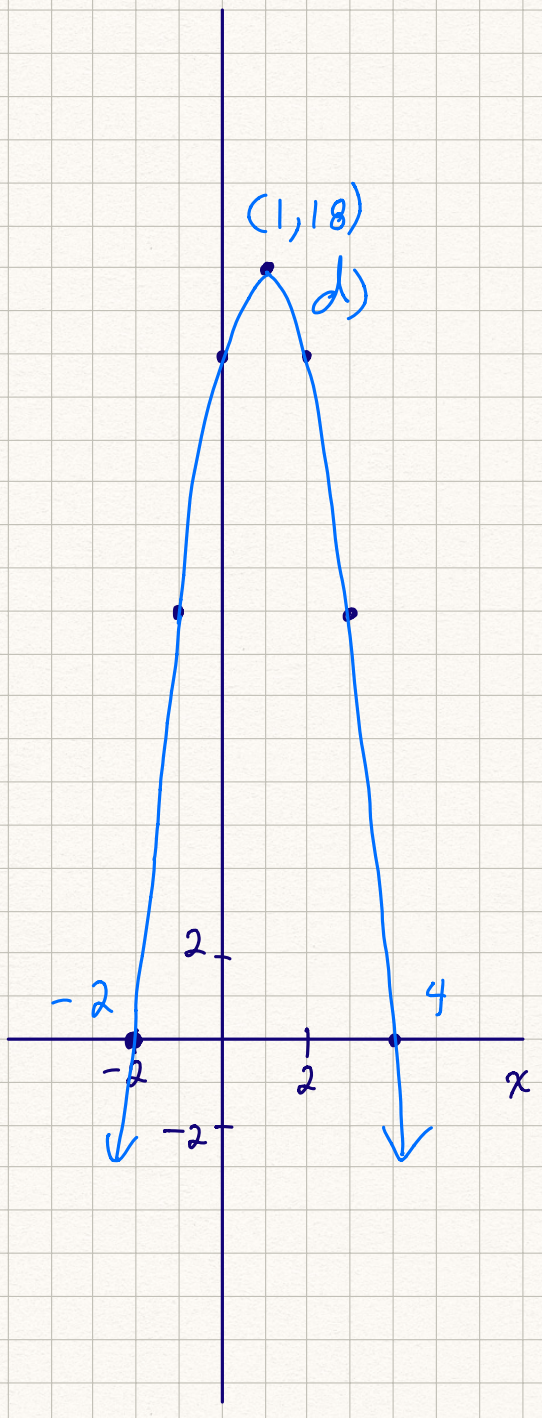


get y-value of vertex:

$y = 2(x-3)(x+2)$
$= 2(0.5-3)(0.5+2)$
$= 2(-2.5)(2.5)$
$= -12.5$

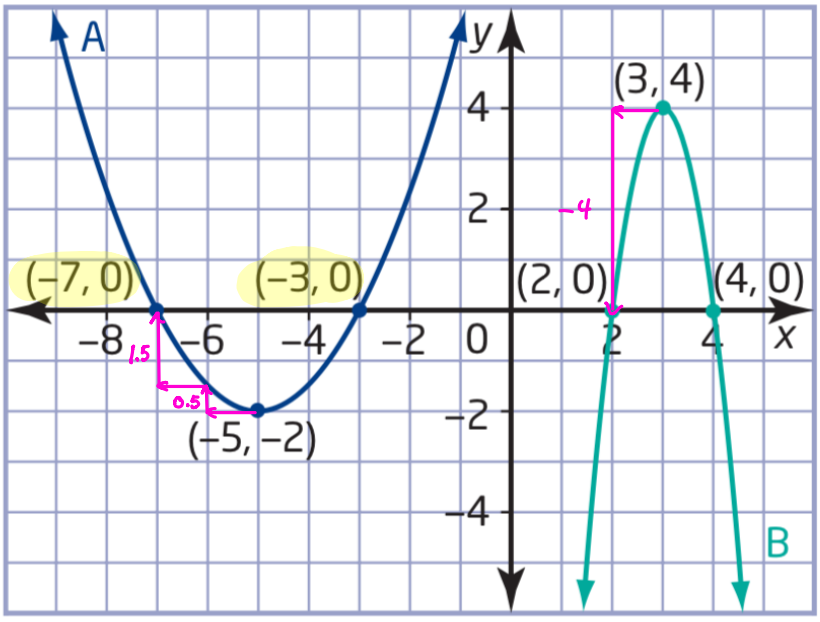
$x = 0.5$





5.

5. Determine an equation in the form $y = a(x - r)(x - s)$ to represent each parabola. Consider the vertex and x-intercepts.



a) analyze step pattern

0.5, 1.5 ... ∴ $a = 0.5$

∴ equation is $y = 0.5(x+7)(x+3)$

b) analyze step pattern

down 4 ∴ $a = -4$

∴ equation is $y = -4(x-2)(x-4)$

Connect and Apply

6. You investigated the graphs of $y = (x - h)^2$ in Section 4.3. Consider the quadratic relation $y = (x - 5)^2$.

a) Write the coordinates of the vertex of the parabola.

b) How many x-intercepts does the parabola have?

c) Rewrite the equation in the form $y = a(x - r)(x - s)$.

6. a) vertex (5, 0)

since $y = (x-5)^2$ same as $y = 1(x-5)^2 + 0$ (h, k)

b) one (really two equal x-ints)

c) $y = (x-5)(x-5)$

x-ints are 5 and 5

7. A parabola has equation $y = (x + 2)^2$.

a) Write its x-intercepts.

b) Determine the coordinates of its vertex.

7 a) $y = (x+2)^2$

$y = (x+2)(x+2)$ one x-intercept (two equal intercepts)

x-ints are -2 and -2 (vertex is on x-axis)

b) $(-2, 0)$

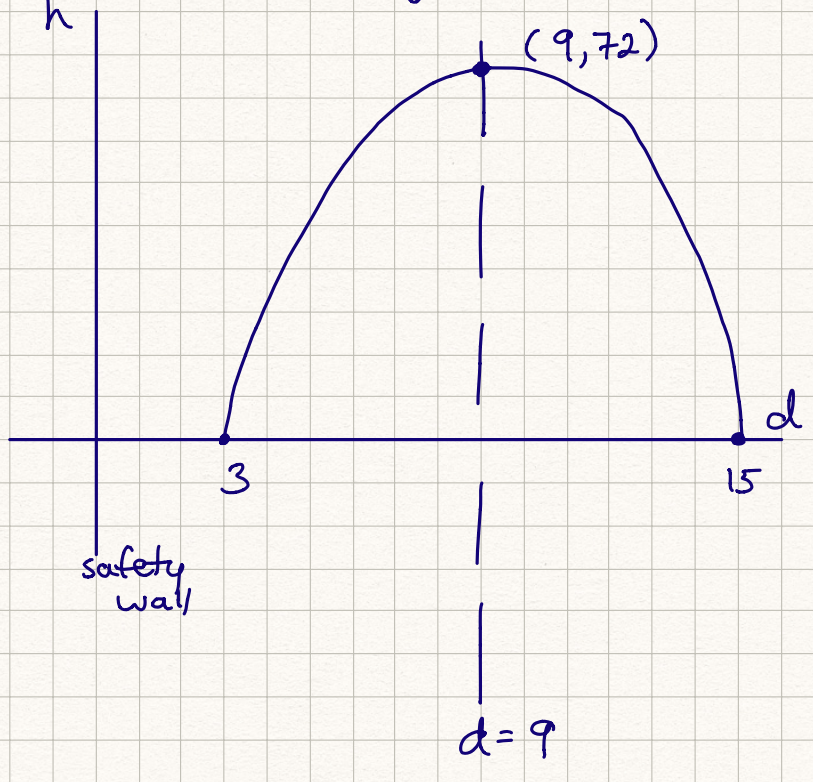
8. The predicted flight path of a toy rocket is defined by the relation $h = -2(d - 3)(d - 15)$, where d is the horizontal distance, in metres, from a safety wall, and h is the height, in metres, above the ground.

a) Sketch a graph of the path of the rocket.

b) How far from the wall is the rocket when it lands on the ground?

c) What is the maximum height of the rocket, and how far, horizontally, is it from the wall at that moment?

a)



b) It is 15 metres from the safety wall.

c) $h = -2(d-3)(d-15)$

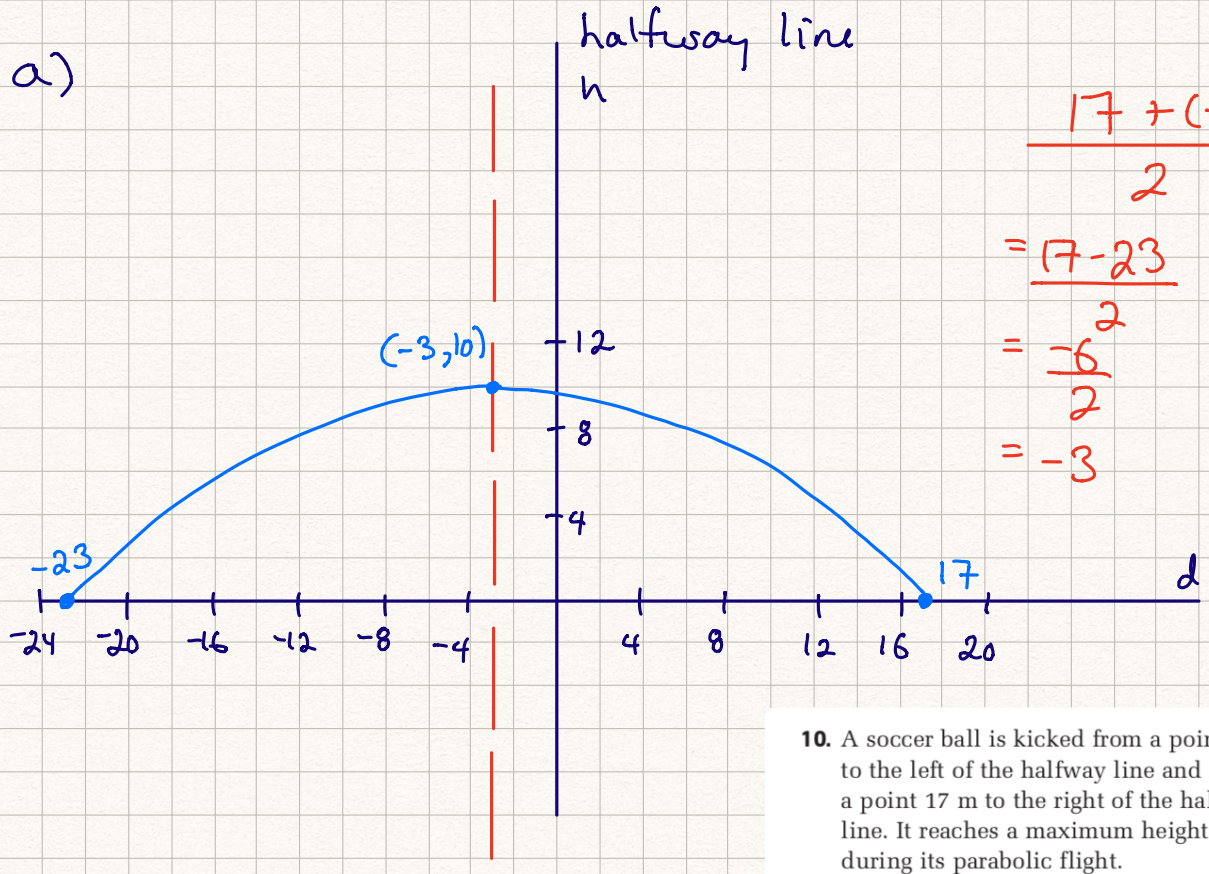
$h = -2(9-3)(9-15)$

$= -2(6)(-6)$

$= 72$

The maximum height is 72 metres. This happens 9 m horizontally from the safety wall.

10. a)



$$\frac{17+(-23)}{2}$$

$$= \frac{17-23}{2}$$

$$= \frac{-6}{2}$$

$$= -3$$

$d = -3$

10. A soccer ball is kicked from a point 23 m to the left of the halfway line and lands at a point 17 m to the right of the halfway line. It reaches a maximum height of 10 m during its parabolic flight.

a) Sketch a graph to show the flight of the soccer ball if the halfway line passes through the origin.

b) Determine an equation to represent the path of the soccer ball.

b) $y = a(x-r)(x-s)$

$10 = a(-3-(-23))(-3-17)$

$10 = a(-3+23)(-20)$

$10 = a(20)(-20)$

$\frac{10}{-400} = \frac{-400a}{-400}$

$-\frac{1}{40} = a$

$\therefore$ equation is

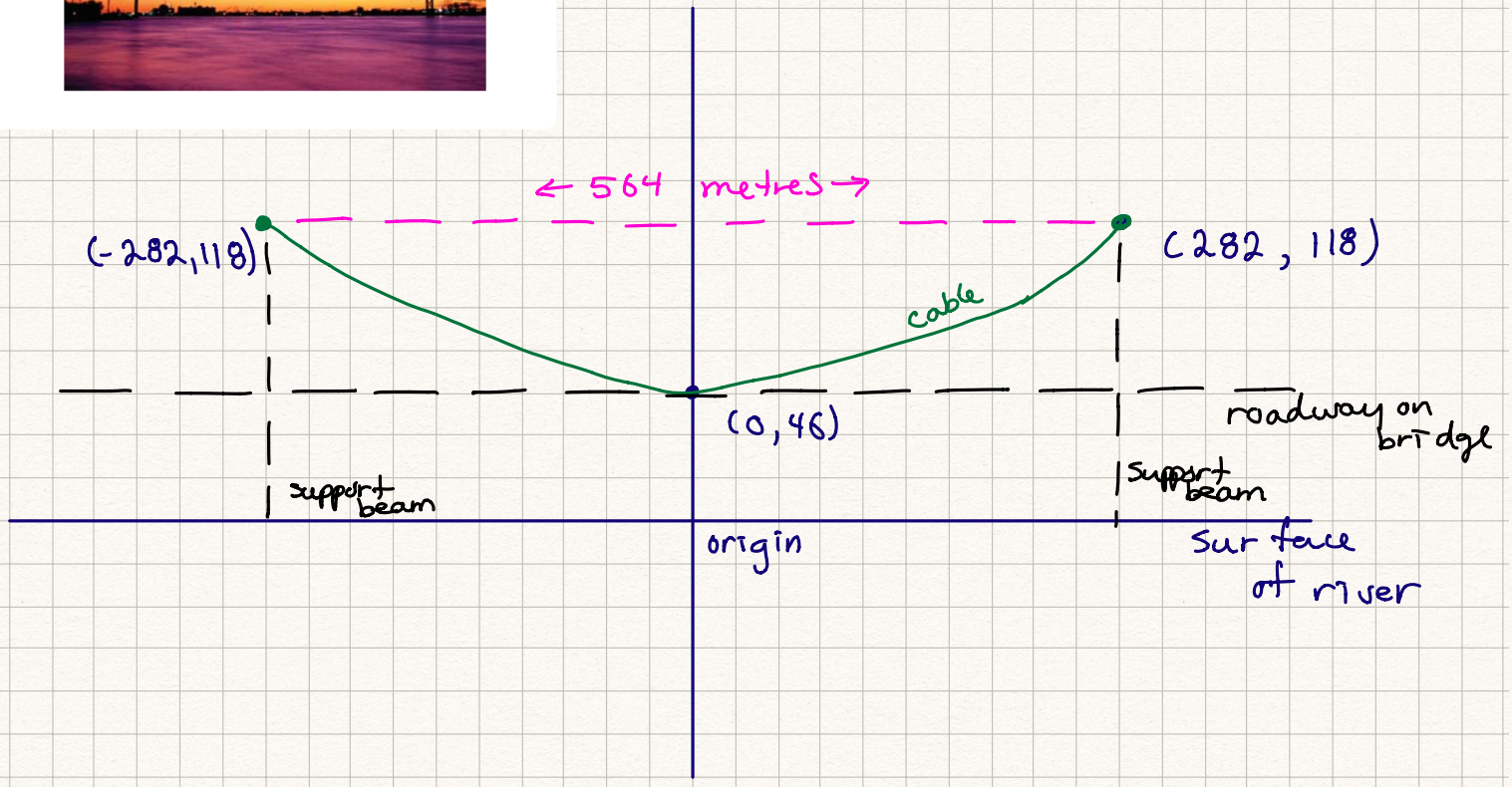
$y = -\frac{1}{40}(x-(-23))(x-17)$

or $y = -\frac{1}{40}(x+23)(x-17)$

11. The Ambassador Bridge is a suspension bridge that crosses the Detroit River and connects Windsor, Ontario, to Detroit, Michigan. The two towers that support the centre span of cables rise 118 m above the river and are 564 m apart. The cable reaches its lowest point approximately 46 m above the river.

a) Sketch a graph to show the curve of the cable if the origin is centred under the lowest point of the cable at the river's surface.

b) Determine an equation to represent the curve of the cables in the form $y = a(x - r)(x - s)$, if possible. If not, explain why.



b) it's not possible to find an equation in the form $y = a(x-r)(x-s)$ to represent the curve of the cables, because the cables do not cross the x-axis (the surface of the river).