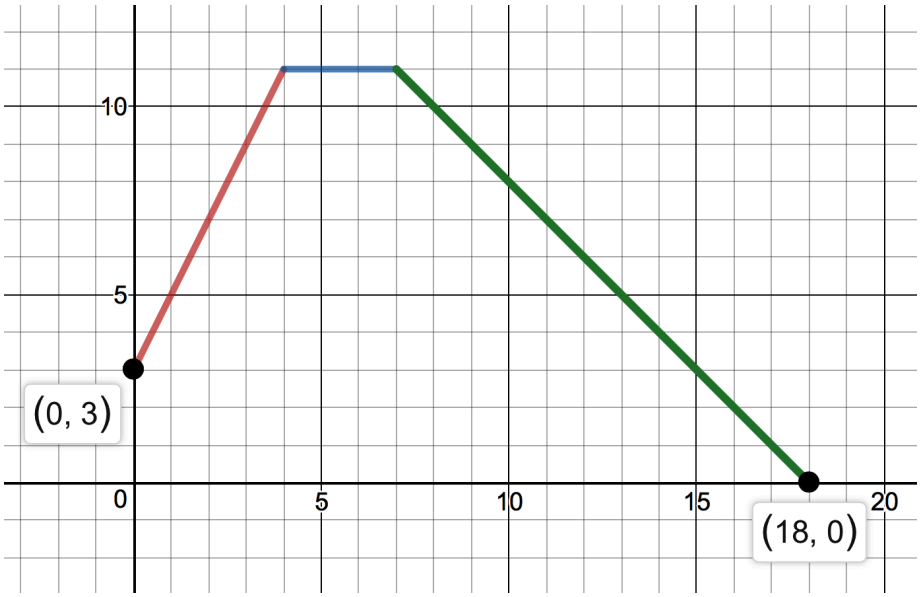
Piece-wise

1. Answer the following questions using the piece-wise graph shown below:



a) Use the coordinates in the graph to complete the information for each of the 3 lines.

$$f(x) = \begin{cases} 2x + 3 & , \quad 0 \le x \le ____ \\ _____ & , \quad ____ \le x \le ____ \\ -x + 18 & , \quad ____ \le x \le 18 \end{cases}$$

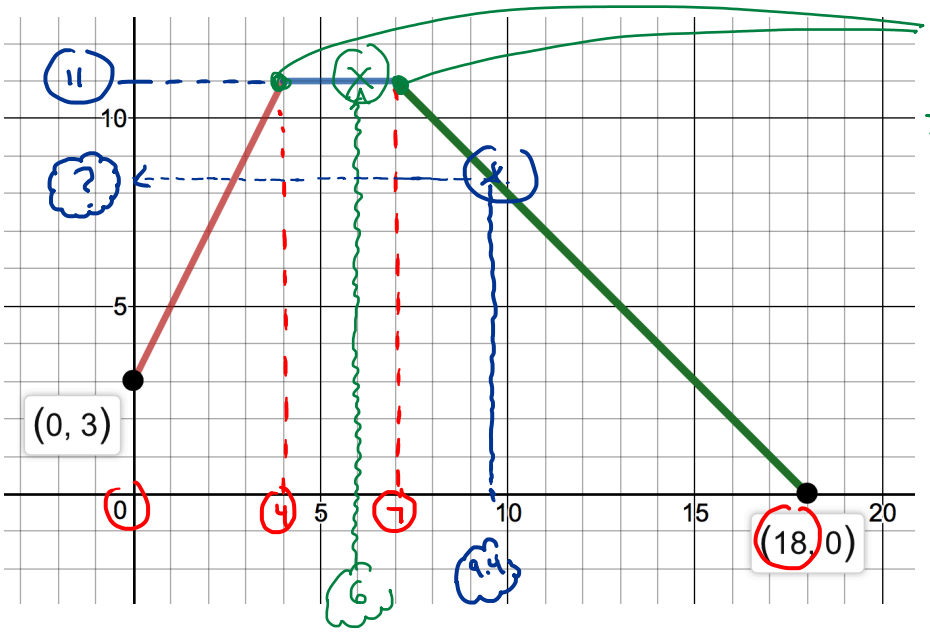
b) Using the above piecewise function, what is …

f (6) = _____ (i.e. what is 'y' when 'x' = 6)

f (9.4) = _____ (i.e. what is 'y' when 'x' = 9.4)

Piece-wise

1. Answer the following questions using the piece-wise graph shown below:



STEP (1) IDENTIFY COORDINATES OF POINTS WHERE THE DIFFERENT LINES BEGIN AND END.

STEP (2) USE THOSE COORDINATES TO FILL IN THE RULES

a) Use the coordinates in the graph to complete the information for each of the 3 lines.

$$f(x) = \begin{cases} 2x + 3 & , \quad 0 \le x \le \underline{4} \\ \underline{11} & , \quad \underline{4} \le x \le \underline{7} \\ -x + 18 & , \quad \underline{7} \le x \le 18 \end{cases}$$

STEP (3) $x = 6$ fits in here... $y = 11$

$x = 9.4$ fits in here...

STEP (4)

Write the rule and plug in the x-value...

$y = -x + 18$

$y = -(9.4) + 18$

$y = -9.4 + 18$

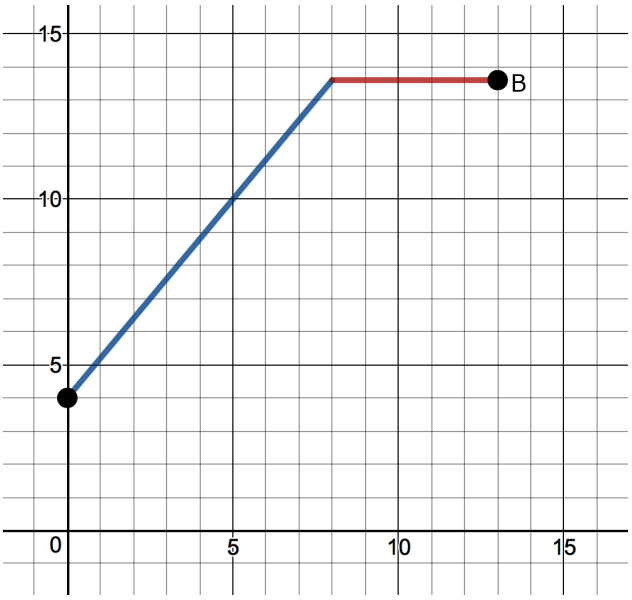
$y = 8.6$

b) Using the above piecewise function, what is ...

f (6) = __11__ (i.e. what is 'y' when 'x' = 6)

f (9.4) = __8.6__ (i.e. what is 'y' when 'x' = 9.4)

2. Answer the following questions using the piece-wise graph shown below:



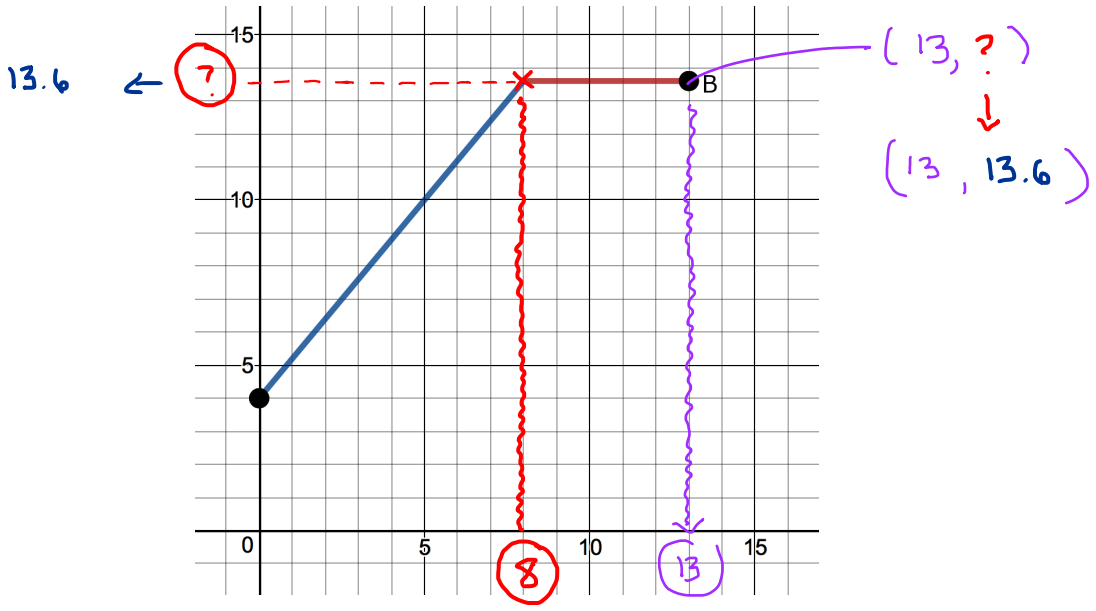
a) Use the coordinates in the graph to complete the information for each of the 2 lines.

$$f(x) = \begin{cases} 1.2x + 4 & , \quad 0 \le x \le 8 \\ _____ & , \quad 8 \le x \le 13 \end{cases}$$

b) What are the coordinates for point B

Answer: B (_____ , _____)

2. Answer the following questions using the piece-wise graph shown below:



a) Use the coordinates in the graph to complete the information for each of the 2 lines.

$$f(x) = \begin{cases} 1.2x + 4 & , \quad 0 \le x \le 8 \\ 13.6 & , \quad 8 \le x \le 13 \end{cases}$$

the last x-value in this equation is $x = 8$

plug it in and find the corresponding y-value.

$y = 1.2x + 4$

$y = 1.2(8) + 4$

$y = 9.6 + 4$

$y = 13.6$

b) What are the coordinates for point B

X - coordinate is 13

y - coordinate is 13.6

Answer: B (13 , 13.6)

3. Answer the following questions using the piece-wise graph shown below:

a) Use the coordinates in the graph to complete the rules for each of the 3 lines.

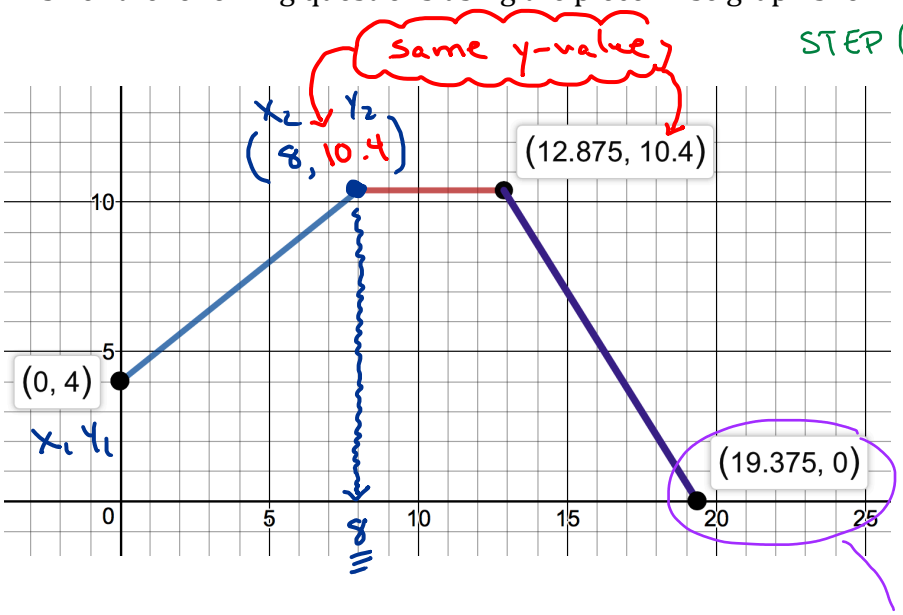
$$f(x) = \begin{cases} _____x + 4 & , \ 0 \leq x \leq 8 \\ _____ & , \ 8 \leq x \leq 12.875 \\ -1.6x + _____ & , \ 12.875 \leq x \leq 19.375 \end{cases}$$

b) Using the above piecewise function, what is $f\ (16.5)$?

(i.e. what is 'y' when 'x' = 16.5)

Answer: $f\ (16.5)$ = _____

3. Answer the following questions using the piece-wise graph shown below:



a) Use the coordinates in the graph to complete the rules for each of the 3 lines.

$$f(x) = \begin{cases} \underline{0.8}\,x + 4 & , \ 0 \le x \le 8 \\ \underline{10.4} & , \ 8 \le x \le 12.875 \\ -1.6x + \underline{31} & , \ 12.875 \le x \le 19.375 \end{cases}$$

STEP (1)

STEP (2)

$y = ax + 4$

$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10.4 - 4}{8 - 0} = \frac{6.4}{8} = 0.8$

$y = 0.8x + 4$

STEP (3)

$y = -1.6x + b$

$0 = -1.6(19.375) + b$

$0 = -31 + b$

$+31 \quad +31$

$31 = b$

$y = -1.6x + 31$

b) Using the above piecewise function, what is f (16.5)?

(i.e. what is 'y' when 'x' = 16.5)

use the last rule ... for x-values from 12.875 to 19.375

STEP (4)

$y = -1.6x + 31$

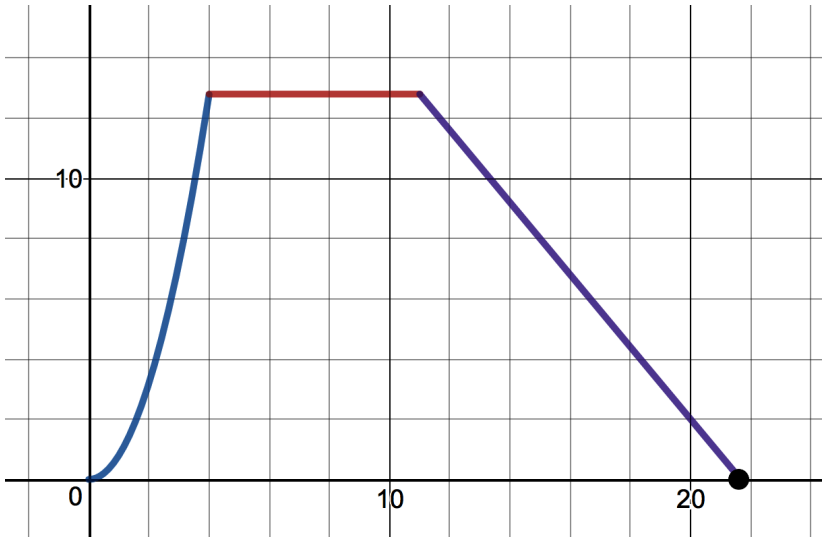
$y = -1.6(16.5) + 31$

$y = -26.4 + 31$

$y = 4.6$

Answer: f (16.5) = 4.6

4. Answer the following questions using the piece-wise graph shown below:



b) Use the coordinates in the graph to complete the rules for each of the 3 lines.

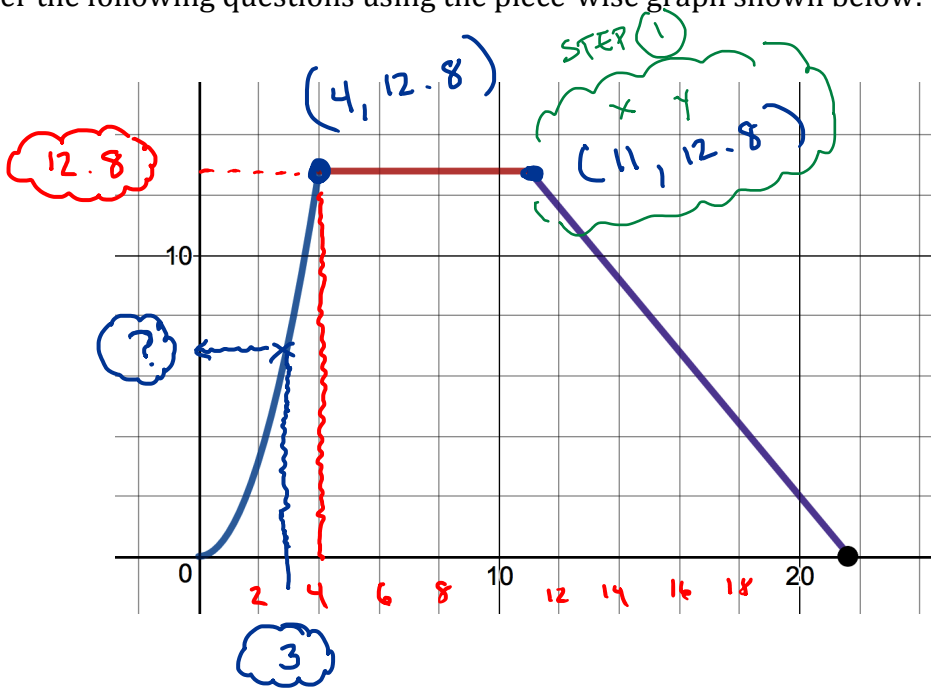
$$f(x) = \begin{cases} _____\, x^2 & , \quad 0 \le x \le 4 \\ 12.8 & , \quad 4 \le x \le 11 \\ ____x + 26 & , \quad 11 \le x \le 21.\overline{6} \end{cases}$$

c) Using the above piecewise function, what is $f\ (3)$?

(i.e. what is 'y' when 'x' = 3)

Answer: $f\ (3)$ = _____

4. Answer the following questions using the piece-wise graph shown below:



b) Use the coordinates in the graph to complete the rules for each of the 3 lines.

$$f(x) = \begin{cases} 0.8x^2 & , \quad 0 \le x \le 4 \\ 12.8 & , \quad 4 \le x \le 11 \\ -1.2x + 26 & , \quad 11 \le x \le 21.\overline{6} \end{cases}$$

STEP 1

STEP 2

$y = ax^2$

$12.8 = a(4)^2$

$\frac{12.8}{16} = \frac{a(16)}{16}$

$0.8 = a$

Rule: $y = 0.8x^2$

STEP 3

$y = ax + 26$

$12.8 = a(11) + 26$

$12.8 = a \cdot (11) + 26$

$-26 \qquad -26$

$\frac{-13.2}{11} = \frac{a(11)}{11}$

$-1.2 = a$

Rule: $y = -1.2x + 26$

c) Using the above piecewise function, what is $f(3)$?

(i.e. what is 'y' when 'x' = 3)

STEP 4

↳ use the first equation, which is good for x-values from 0 to 4.

$y = 0.8x^2$

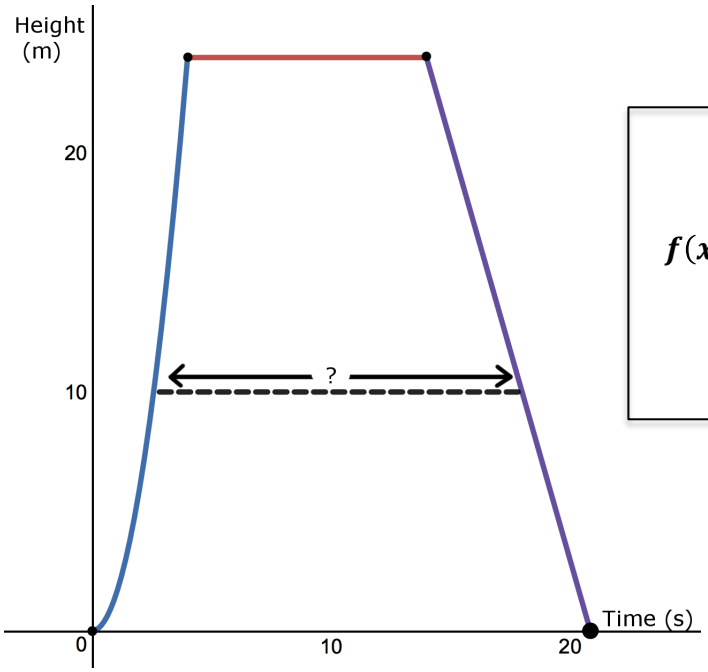
$y = 0.8(3)^2$

$y = 0.8(9)$

$y = 7.2$

Answer: $f(3) =$ 7.2

5. As part of a science experiment, a model helicopter is sent up into the air, hovers for a bit, then falls back to the ground with a parachute.
The helicopter's altitude is recorded over time, and displayed in the piece-wise graph below.

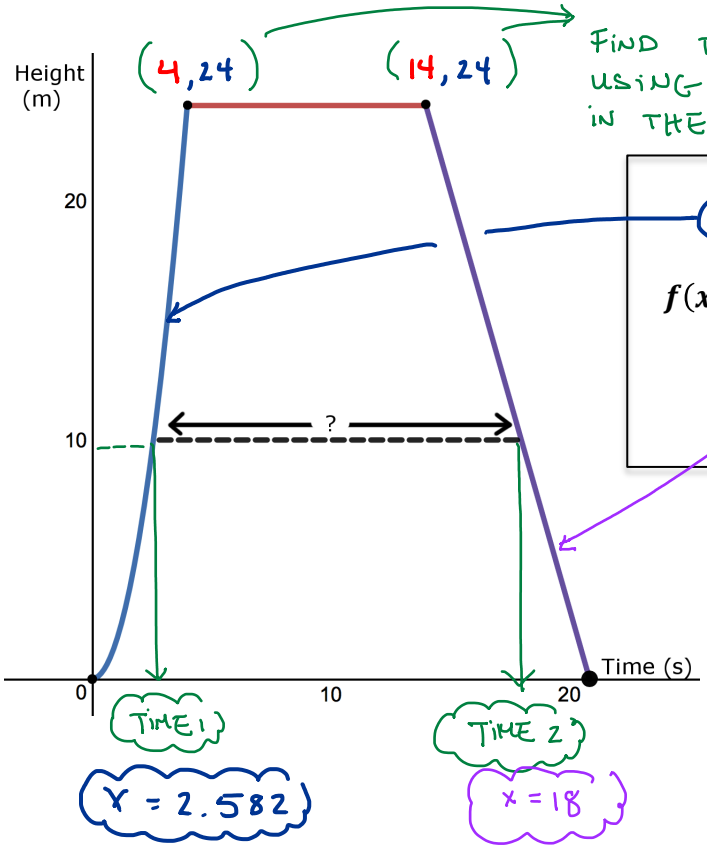


$$f(x) = \begin{cases} 1.5\,x^2 & , \quad 0 \le x \le 4 \\ 24 & , \quad 4 \le x \le 14 \\ -3.5x + 73 & , \quad 14 \le x \le 20.8\overline{6} \end{cases}$$

To the nearest tenth of a second, how long did the helicopter have an altitude greater than or equal to 10 m?

Answer: *The helicopter had an altitude of at least* 10 *m for* _____ seconds

5. As part of a science experiment, a model helicopter is sent up into the air, hovers for a bit, then falls back to the ground with a parachute.
The helicopter's altitude is recorded over time, and displayed in the piece-wise graph below.



FIND THE TWO POINTS USING THE INFORMATION IN THE PIECE-WISE FORMULAS

$$f(x) = \begin{cases} 1.5x^2, & 0 \le x \le 4 \\ 24, & 4 \le x \le 14 \\ -3.5x + 73, & 14 \le x \le 20.8\overline{6} \end{cases}$$

To the nearest tenth of a second, how long did the helicopter have an altitude greater than or equal to 10 m? → THIS IS THE 'y-VALUE' WE CARE ABOUT...

TIME 1:

$y = 1.5x^2$

$\frac{10}{1.5} = \frac{1.5x^2}{1.5}$

$\sqrt{6.\overline{6}} = \sqrt{x^2}$

$2.582 = x$

TIME 2:

$y = -3.5x + 73$

$10 = -3.5x + 73$

$-73 \quad -73$

$\frac{-63}{-3.5} = \frac{-3.5x}{-3.5}$

$18 = x$

TIME IN BETWEEN:

$= \text{TIME}_2 - \text{TIME}_1$

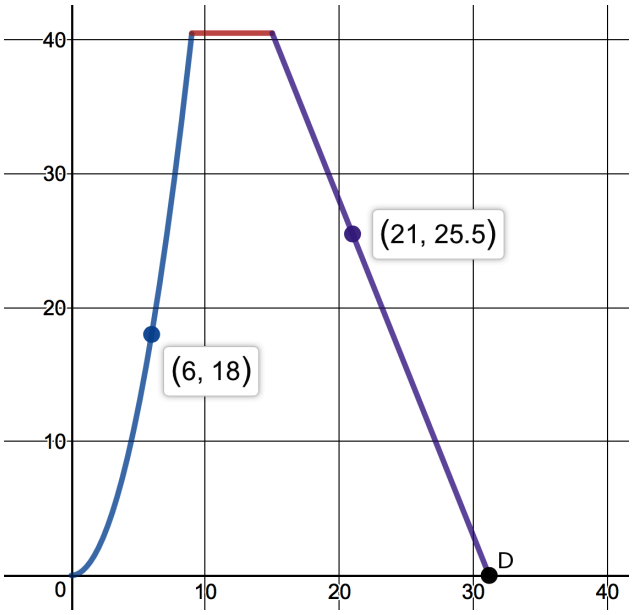
$= 18 - 2.582$

$= 15.418$

≈ 15.4 seconds

Answer: *The helicopter had an altitude of at least* 10 *m for* 15.4 seconds

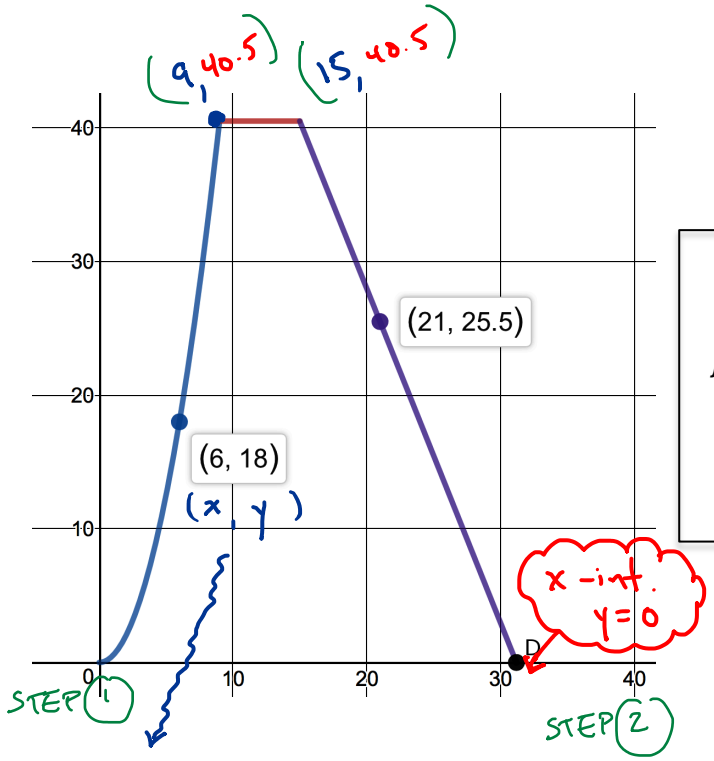
6. Find the coordinates of point D using the information about the piece-wise function below.



$$f(x) = \begin{cases} _____\, x^2 & , \quad 0 \le x \le 9 \\ _____ & , \quad 9 \le x \le 15 \\ ___x + _____ & , \quad 15 \le x \le __ \end{cases}$$

Answer: D (_____ , _____)

6. Find the coordinates of point D using the information about the piece-wise function below.



LINE 1 ENDS @ $x = 9$ and LIN 2 STARTS @ $x = 9$.

$$f(x) = \begin{cases} 0.5\,x^2 & , \quad 0 \le x \le 9 \\ 40.5 & , \quad 9 \le x \le 15 \\ -2.5x + 78 & , \quad 15 \le x \le __ \end{cases}$$

STEP 3

$y = ax + b$

$(x_1, y_1) = (21, 25.5)$

$(x_2, y_2) = (15, 40.5)$

$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{40.5 - 25.5}{15 - 21} = \frac{15}{-6}$

$a = -2.5$

$y = -2.5x + b$

$40.5 = -2.5(15) + b$

$40.5 = -37.5 + b$

$+37.5 \quad +37.5$

$78 = b$

$y = ax^2$

$18 = a(6)^2$

$\frac{18}{36} = \frac{a(36)}{36}$

$0.5 = a$

Rule ①: $y = 0.5x^2$

$y = c$

(find the y-value @ the end of the first quadratic equation. ($x = 9$))

$y = 0.5x^2$

$y = 0.5(9)^2$

$y = 40.5$

Rule ②: $y = 40.5$

Rule ③: $y = -2.5x + 78$

STEP 4

$0 = -2.5x + 78$

$-78 \quad -78$

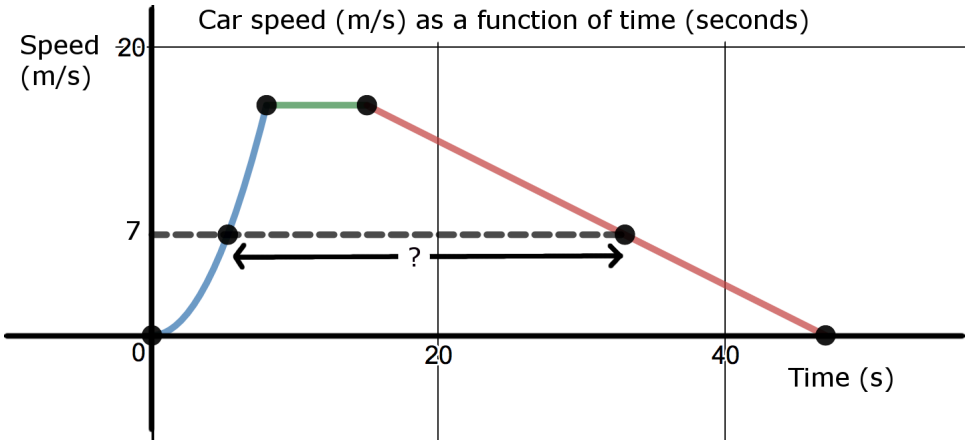
$\frac{-78}{-2.5} = \frac{-2.5x}{-2.5}$

$31.2 = x$

Answer: D (31.2 , 0)

7. A car accelerates, holds a certain speed, then brakes before coming to a complete stop. The car's speed is measured as of the moment it starts moving.

For how much time was the car at or above a speed of 7 meters per second? Give your final answer to the nearest tenth of a second.

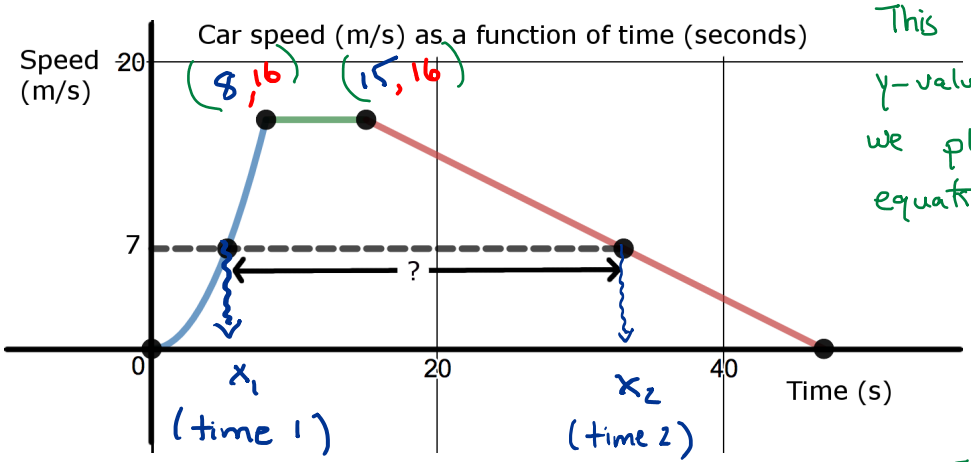


$$f(x) = \begin{cases} a\,x^2 & , \quad 0 \le x \le 8 \\ 16 & , \quad 8 \le x \le 15 \\ ax + 23.5 & , \quad 15 \le x \le 47 \end{cases}$$

To the nearest tenth of a second, the car had a speed greater than or equal to 7 m/s for _____ seconds.

7. A car accelerates, holds a certain speed, then brakes before coming to a complete stop. The car's speed is measured as of the moment it starts moving.

For how much time was the car at or above a speed of 7 meters per second? Give your final answer to the nearest tenth of a second.



This is the y-value that we plug into the equations to find 'x'

$$f(x) = \begin{cases} a x^2 & , \quad 0 \le x \le 8 \\ 16 & , \quad 8 \le x \le 15 \\ ax + 23.5 & , \quad 15 \le x \le 47 \end{cases}$$

STEP 1

$y = a x^2$

$16 = a(8)^2$

$\frac{16}{64} = \frac{a(64)}{64}$

$0.25 = a$

STEP 2

Time 1 (x_1):

$y = 0.25 x^2$

$\frac{7}{0.25} = \frac{0.25 x^2}{0.25}$

$\sqrt{28} = \sqrt{x^2}$

$5.292 = x$

STEP 3

$y = ax + 23.5$

$16 = a(15) + 23.5$

$-23.5 \qquad -23.5$

$\frac{-7.5}{15} = \frac{a(15)}{15}$

$-0.5 = a$

STEP 4

Time 2 (x_2)

$y = -0.5x + 23$

$7 = -0.5x + 23$

$-23 \qquad -23$

$\frac{-16}{-0.5} = \frac{-0.5x}{-0.5}$

$32 = x$

STEP 5

$\text{Time} = x_2 - x_1$

$= 32 - 5.292 = 26.708$

To the nearest tenth of a second, the car had a speed greater than or equal to 7 m/s for 26.7 seconds.