

2.7 Hw Solutions

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Question 1:

Solution:



a.)

If:

$$m_{tan} = \lim_{x \rightarrow -3} \frac{f(x) - f(a)}{x - a}.$$

And **a = -3, f(a) = -18, then:**

$$\begin{aligned} m_{tan} &= \lim_{x \rightarrow -3} \frac{x^2 + 9x - (-18)}{x - (-3)} \\ &= \lim_{x \rightarrow -3} \frac{x^2 + 9x + 18}{x + 3}. \end{aligned}$$

numerator factors into:

$$\lim_{x \rightarrow -3} \frac{(x + 3)(x + 6)}{x + 3}.$$

Cancel out common factor:

$$\lim_{x \rightarrow -3} x + 6.$$

Plug in -3 for x

$$\begin{aligned} m_{tan} &= -3 + 6 \\ &= 3. \end{aligned}$$

b.)

If:

$$m_{tan} = \lim_{h \rightarrow 0} \frac{f(a + h) - f(a)}{h}.$$

And a = -3 and f(a) = -18, and we plug in (a+h) for x:

$$m_{tan} = \lim_{h \rightarrow 0} \frac{(-3 + h)^2 + 9(-3 + h) - (-18)}{h}.$$

And we distribute out the terms:

$$\begin{aligned} m_{tan} &= \lim_{h \rightarrow 0} \frac{h^2 - 6h + 9 - 27 + 9h - 18}{h} \\ &= \frac{h^2 + 3h}{h} \\ &= \frac{h(h + 3)}{h} \\ &= h + 3. \end{aligned}$$

Now if we plug in zero:

$$\begin{aligned} m_{tan} &= 0 + 3 \\ &= 3. \end{aligned}$$

c.) The equation of the tangent line is:

$$y - y_1 = m(x - x_1)$$

Then:

$$\begin{aligned} y - (-18) &= 3(x - (-3)) \\ y + 18 &= 3(x + 3) \\ y + 18 &= 3x + 9 \\ y &= 3x - 9. \end{aligned}$$

Question 2:

Solution:



We know that:

$$m_{tan} = \lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}.$$

And $a = 6$ and $f(a) = 19$:

$$\begin{aligned} \lim_{x \rightarrow 6} \frac{2x^2 - 9x - 1 - 19}{x - 19} \\ = \lim_{x \rightarrow 6} \frac{2x^2 - 9x - 18}{x - 19}. \end{aligned}$$

factor using the x method:

$$\begin{aligned} \lim_{x \rightarrow 6} \frac{(2x + 3)(x - 6)}{x - 6} \\ = \lim_{x \rightarrow 6} 2x + 3 \\ = 2(6) + 3 \\ = 15. \end{aligned}$$

Plug $m_{tan} = 15$ into **Point slope form equation** to get equation of tangent line:

$$\begin{aligned} y - 19 &= 15(x - 6) \\ y - 19 &= 15x - 90 \\ y &= 15x - 71. \end{aligned}$$

Question 3:

Solution:

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a.)

If:

$$m_{tan} = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}.$$

Then:

$$m_{tan} = \lim_{h \rightarrow 0} \frac{4 + 5(a+h)^2 - 2(a+h)^3 - (4 + 5a^2 - 2a^3)}{h}.$$

Distribute -1 to each term in $4 + 5a^2 - 2a^3$

$$= -4 - 5a^2 + 2a^3.$$

Foil out $-2(a+h)^3$

$$= -2a^3 - 2h^3 - 6a^2h - 6ah^2.$$

Foil out $5(a+h)^2$

$$= 5a^2 + 5h^2 + 10ah.$$

And we also have the 4 in the beginning, so combine like terms

$$-2h^3 - 6a^2h - 6ah^2 + 5h^2 + 10ah.$$

Add to equation:

$$\lim_{h \rightarrow 0} \frac{-2h^3 - 6a^2h - 6ah^2 + 5h^2 + 10ah}{h}.$$

factor out a h , and cancel out common term h

$$\begin{aligned} \lim_{h \rightarrow 0} \frac{h(-2h^2 - 6a^2 - 6ah + 5h + 10a)}{h} \\ = -2h^2 - 6a^2 - 6ah + 5h + 10a. \end{aligned}$$

Plug in zero for each h

$$\begin{aligned} -2(0)^2 - 6a^2 - 6a(0) + 5(0) + 10a \\ = -6a^2 + 10a. \end{aligned}$$

b.) Plug in 1 for x,

$$\begin{aligned} m &= -6(1)^2 + 10(1) \\ &= 4. \end{aligned}$$

Plug into point slope form equation

$$\begin{aligned} y - 7 &= 4(x - 1) \\ y &= 4x + 3. \end{aligned}$$

Question 4:

Solution:



Question 5:

Solution:



Question 6:

Solution:



Question 7:

Solution:



Question 8:

Solution:



Question 9:

Solution:



Question 10:

Solution:

