2.6 Hw Solutions

Nathan Warner

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Question 1:

Solution: **See Hw** ☺

Question 2:

Solution: ☺

1.) We want to divide each term in the numerator and denominator by x^2

$$\lim_{x\to\infty} \frac{\frac{8x^2}{x^2} - \frac{3}{x^2}}{\frac{7x^2}{x^2} + \frac{x^2}{x^2} - \frac{3}{x^2}}.$$

Which simplifys to:

$$\lim_{x\to\infty} \frac{8 - \frac{3}{x^2}}{7 + \frac{1}{x} - \frac{3}{x^2}}.$$

and if we take the limit of each of these terms, we get:

$$\frac{8-0}{7+0-0}$$
$$= \frac{8}{7}.$$

Note:-

Remember from pre-calc, to find the H.A of a rational function when the degree of the denominator ***Equals*** the degree of the numerator. The answer is found by ***Dividing the coefficients*** **from the terms with the highest exponents**

Question 3:

Solution: Same concept as Question 2. ☺

Question 4:

Solution: ☺

1.) If we divide each of terms by the degree of the denominator, x then we get:

$$\lim_{x\to\infty} \frac{\frac{-7}{x}}{2+\frac{5}{x}}.$$

2.) and if we take the limit of each of the terms in both the numerator and denominator. We get:

$$\frac{0}{2+0}$$
$$= 0.$$

Note:-

Remember from pre-calc, that if the degree of the denominator is higher than the degree in the numerator, the H.A is $\boldsymbol{y = 0}$

Question 5:

Solution: ☺

1.) Reverse factor the equation and get:

$$\lim_{x\to-\infty} \frac{7u^4+6u^2-1}{u^4+18u^2+81}.$$

Now divide both sides by the highest term in the denominator: x^4

$$\lim_{x\to-\infty} \frac{\frac{7u^4}{u^4}+\frac{6u^2}{u^4}-\frac{1}{u^4}}{1+\frac{18u^2}{u^4}+\frac{81}{u^4}}.$$

Simplify and get:

$$\lim_{x\to-\infty} \frac{7+\frac{6}{u^2}-\frac{1}{u^4}}{1+\frac{18}{u^2}+\frac{81}{u^4}}.$$

Take the limit of each term and we are left with:

$$\frac{7+0-0}{1+0+0}$$
$$= 7.$$

Question 6:

Solution: 😄

1.) Divide each side by x^4

$$\lim_{x \to -\infty} \frac{\frac{4x^5}{x^4} - \frac{x}{x^4}}{\frac{x^4}{x^4} + \frac{5}{x^4}}.$$

Which simplifies to:

$$\lim_{x \to -\infty} \frac{4x - \frac{1}{x^3}}{1 + \frac{5}{x^4}}.$$

Now take the limit of each term:

$$\begin{aligned} &\frac{4(-\infty) - 0}{1 + 0} \\ &= \frac{-\infty}{1} \\ &= -\infty. \end{aligned}$$

Question 7:

Solution: 😄

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Question 8:

Solution: 😄

As x approaches 0 from the right, ln(x) decreases without bound.

So if take:

$$\lim_{x \to -\infty} \arctan(x).$$

We get $-\frac{\pi}{2}$, this is because of arctans asymptotes.

Then if we multiply that by 3, we get:

$$\begin{aligned} &3 \cdot -\frac{\pi}{2} \\ &= -\frac{3\pi}{2}. \end{aligned}$$

Question 9:

Solution:

For H.A, divide both halfs by x^2 and simplify:

$$\lim_{x\to\infty} \frac{2+\frac{3}{x^2}}{3+\frac{14}{x}-\frac{5}{x^2}}.$$

Take the limits of each term:

$$\frac{2+0}{3+0-0}$$
$$=\frac{2}{3}.$$

Notice it would be the same for $\lim\limits_{x\to-\infty}$, Therefore our only H.A is y= $\frac{1}{3}$

For V.A, Factor the equation and find the zeros of the denominator. Notice we cannot factor the top, but the bottom factors into:

$$(3x-1)(x+5).$$

So our V.A's are, x = -5, $\frac{1}{3}$

Question 10:

Solution:

Part 1.)

Set equation = 0, solve for x:

$$e^x-3=0$$
$$e^x=3$$
$$x=ln(3).$$

Part 3.)

Find: $\lim\limits_{x\to-\infty} \frac{7e^x}{e^x-3}$

Since $e^{-\infty}=0$, our equation is:

$$\frac{7(0)}{0-3}$$
$$=\frac{0}{-3}$$
$$=0.$$

Find: $\lim_{x \to \infty} \frac{7e^x}{e^x - 3}$

Divide both halfs by e^x

$$\begin{aligned}\lim_{x\to\infty} \frac{7}{1-\frac{3}{e^x}} \\ = \frac{7}{1} \\ = 7.\end{aligned}$$

So our V.A is the answer we found in part 1, and our H.A is what we just found in part 3

Question 11:

Solution: 😄

The first condition, $\lim_{x \to \pm\infty} f(x) = 0$, Tells us that y = 0 is a H.A, this means that the degree of the numerator is less than the degree of the denominator.

The condition to the right tells us that x = 0 is a V.A, so we need $-x^2$ in the denominator. ***Negative because of -*** ∞

The next condition tells us that there is a factor of (x-4) in the numerator.

The last 2 conditions tells us that x = 5 is a V.A and therefore (x-5) belongs in the denominator.

So our equation is:

$$\frac{x-4}{-x^2(x-5)}.$$

Question 11:

Solution: 😄

$$20 \cdot 25 = 500.$$

So:

$$\begin{aligned}\frac{500t}{6000+25t} \\ = \frac{25(20t)}{6000+25t} \\ = \frac{25(20t)}{25(240+t)} \\ = \frac{20t}{240+t}.\end{aligned}$$

Part b.)

$$\lim_{t\to\infty} \frac{20t}{240+t}.$$

Divide each term by t:

$$\lim_{x\to\infty} \frac{\frac{20t}{t}}{\frac{240}{t}+\frac{t}{t}}.$$

Simplify:

$$\lim_{x\to\infty} \frac{20}{\frac{240}{t}+1}.$$

Take limit of each term:

$$\frac{20}{0+1}$$
$$= 20.$$