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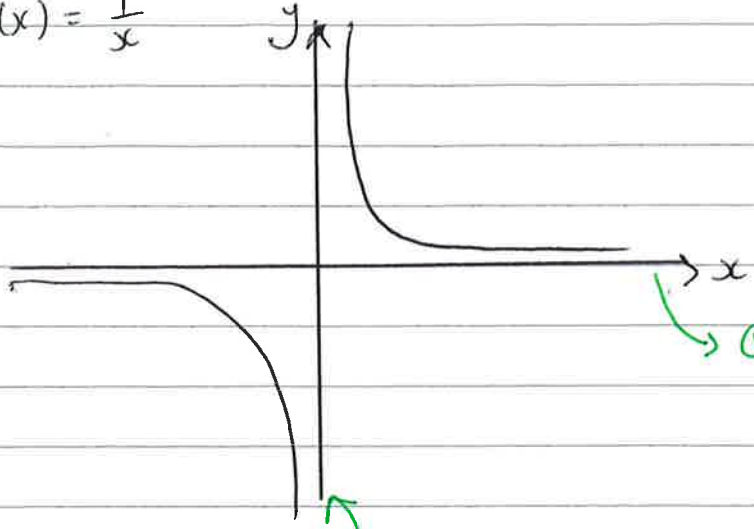
## Approaching Asymptotes

$f(x) = \frac{1}{x}$




① Asymptote on the line $y = 0$ (Horizontal)

② Asymptote on the line $x = 0$ (Vertical)

The graph above for $f(x) = \frac{1}{x}$ has two asymptotes described in green. An asymptote is a line which a curve approaches as the curve moves away from zero where the variable of the function (in this case $x$) ~~are~~ $x \to \infty$ or $x \to -\infty$ depending on the graph. The distance between the curve (as $x \to \infty$ or $x \to -\infty$) ~~tends~~ and the asymptote tends towards zero.

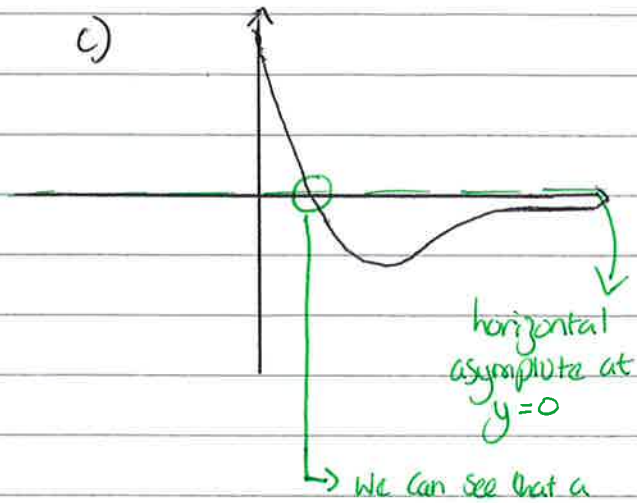
The different types of asymptotes are

- Horizontal
- Vertical
- Oblique

MAIN PROBLEM

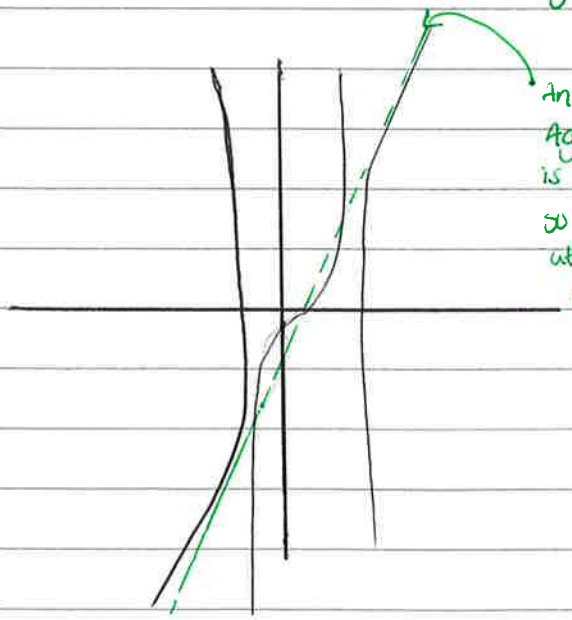
1. "An asymptote is a line which a curve gets closer & closer to but doesn't meet"
This statement is false which can be seen in graphs c) and d)

c)



horizontal asymptote at $y=0$

We can see that a curve can actually cross an asymptote therefore intersects the asymptote line. As this curve ~~approaches~~ approaches $x \to \infty$ the curve will not meet the asymptote at $y=0$.



An oblique asymptote
Again part of the graph is crossing this asymptote so the function is defined at some point to meet the asymptote again but the description included as $x \to \infty$ or $x \to -\infty$ this statement may have been true.

(3)

2) "An asymptote ~~line~~ is a line which a curve approaches as $x \to \infty$".

This statement is true to a certain degree, however there are asymptotes which exist that are not included in this description, such as asymptotes when a curve approaches at $x \to -\infty$.

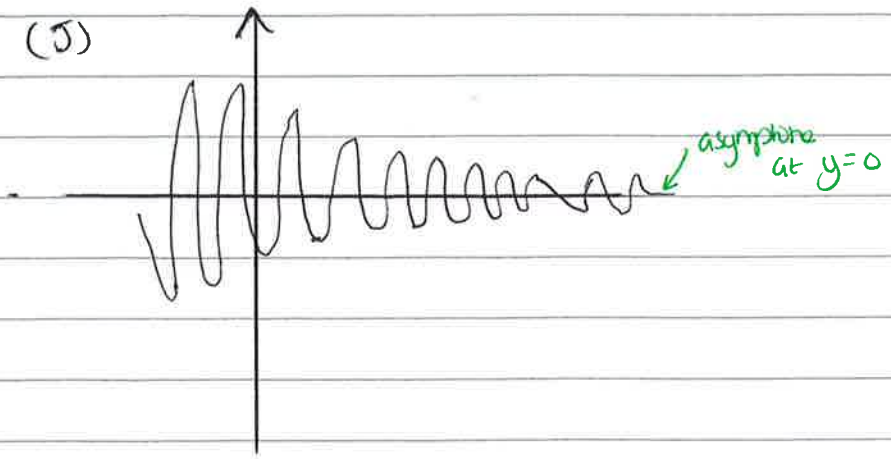
Graph (F) can be taken as an example here


3) "A curve can't cross an asymptote"

This is only true for vertical asymptotes as a function can only have one value mapped to every x but ~~any~~ value can map to more than one x value.
A curve can cross a horizontal & oblique asymptote so the statement is not completely true

Graph (J) is an example of why the statement is false as the curve crosses the asymptote ~~on~~ on the line $y=0$ infinitely many times

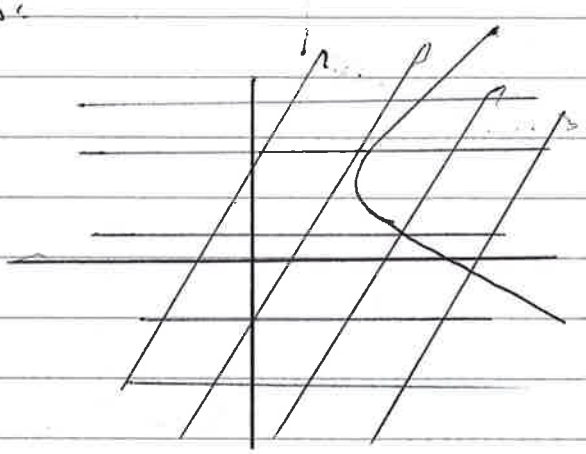
(J)



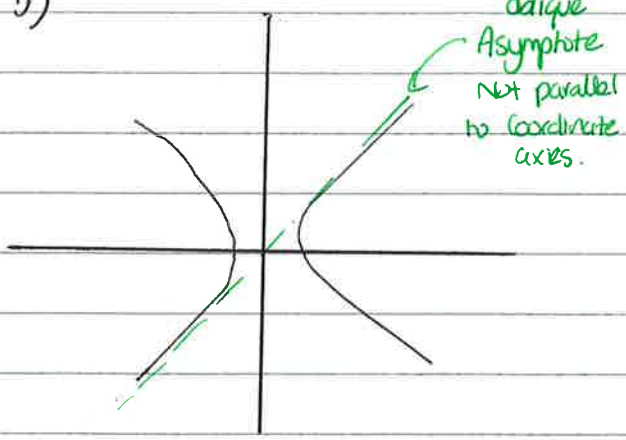
(4)

4) "Asymptotes are parallel to the coordinate axes"

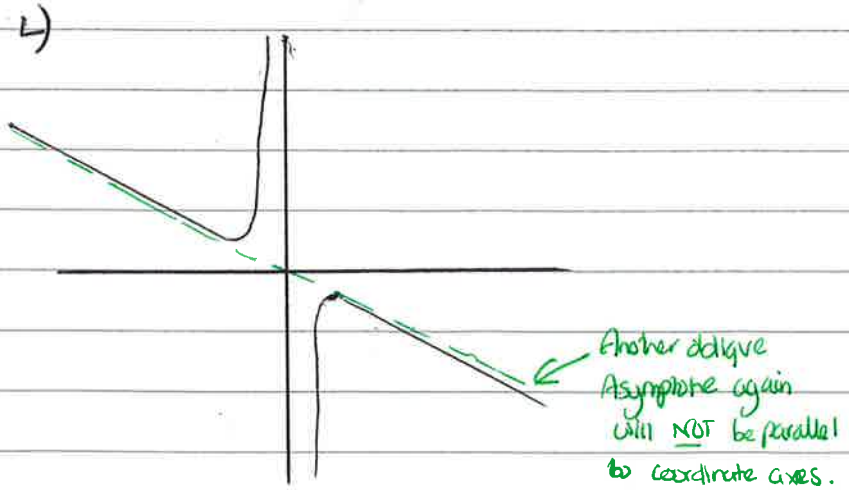
This may be true for vertical & horizontal asymptotes but will be false for oblique asymptotes some examples of graphs which show this are illustrated below:



D)




4)

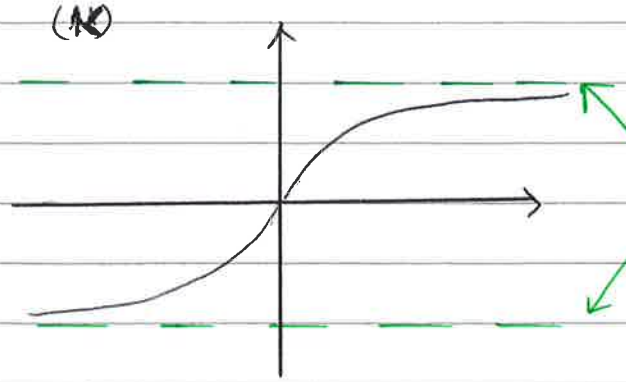


(5)

5) "A graph can only have one asymptote parallel to each axis"

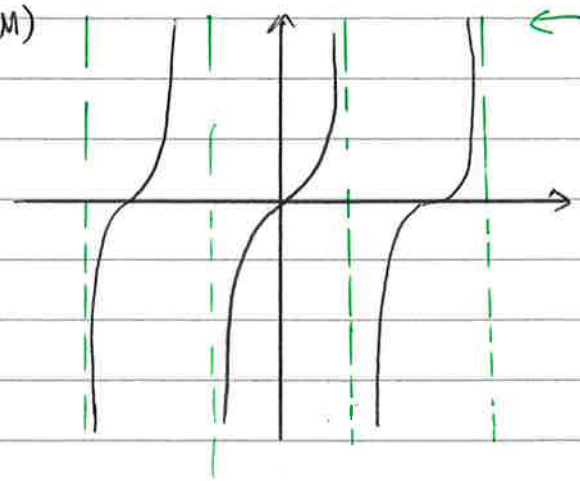
This is false graphs M) and K) show more than one asymptote parallel to the coordinate axes:

(K)



2 horizontal asymptotes parallel to the x axis.

(M)



← Again more than one asymptote, parallel to the cordinate ~~x~~ y axis.

6) "~~An~~ Asymptotes occur when a function isn't defined for certain input values"

This statement is not always true particularly for horizontal asymptotes as every x input to the function is defined, it is just the distance between the curve & the asymptote becomes arbitrarily smaller as $x \to \infty$ or $x \to -\infty$ (depending on the graph). K) shown in the previous answer (5) is an example of why this statement is false, every value for x is defined even though there are two horizontal asymptotes.

7) "A function tends to positive infinity on one side of an asymptote and tends to negative infinity on the other side."

Graph (P) is an example where the above statement is not true