p 030 q13

13. The speed of a vehicle the moment the brakes are applied can be determined by its skid marks. The length, D, in feet, of the skid mark is related to the speed, S, in miles per hour, of the vehicle before braking by the function $D = \frac{1}{30fn}S^2$, where f is the drag factor of the road surface and n is the braking efficiency as a decimal. Suppose the braking efficiency is 100% or 1.

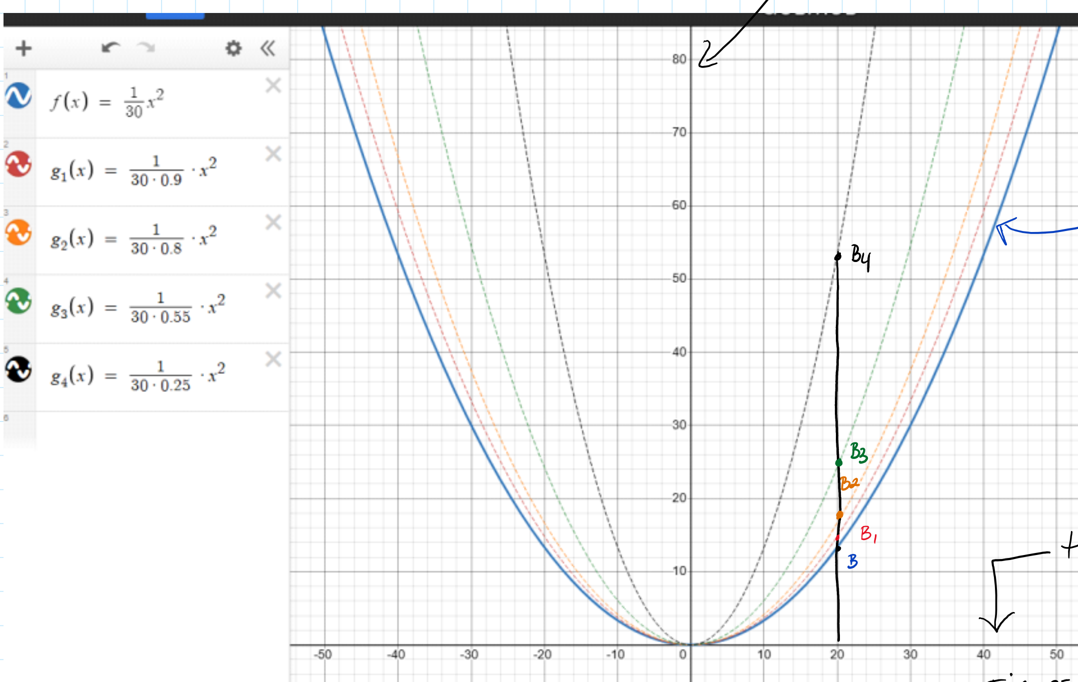
a) Sketch the graph of the length of the skid mark as a function of speed for a drag factor of 1, or $\boxed{D = \frac{1}{30}S^2}$.

b) The drag factor for asphalt is 0.9, for gravel is 0.8, for snow is 0.55, and for ice is 0.25. Compare the graphs of the functions for these drag factors to the graph in part a).

axis

this is $y=f(x)=$ represents $D(S)$ i.e. the distance traveled as a function of S, the speed.

a) https://www.desmos.com/calculator/n3weugr34t
snows the sketches of al these drag factors



$D(S)$:

this is $D = \frac{1}{30} S^2 = D(S)$

shown as f

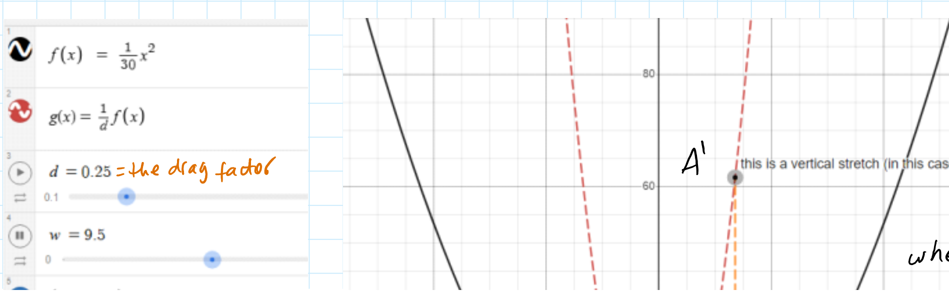
S is shown as x

this axis is x and represents the speed S

FIGURE 1

Let's compare the graphs using this animation:

https://www.desmos.com/calculator/xfornwragf



this is our base $D = \frac{1}{30} S^2$ seen here as $f(x) = \frac{1}{30} x^2$

when comparing point

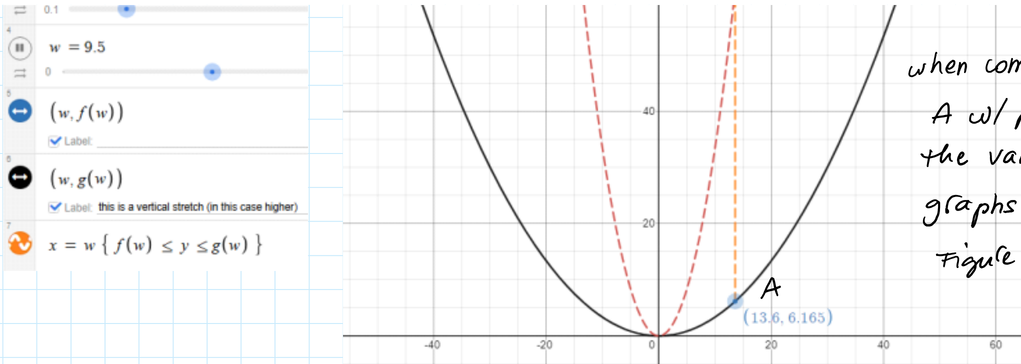


FIGURE2

when comparing point A w/ points A' on the various drag graphs (dotted lines in Figure 1 & 2) we see that the y of A' is higher, i.e. more stretched than the y of A.

So initially we see a drag < 1.0 will cause a vertical stretch that increases the y.

When compared to each other, for ex. points B_1, B_2, B_3, B_4 & B_5 on Figure 1 shows $y_B < y_{B_1} < y_{B_2} < y_{B_3} < y_{B_4}$

& when looking @ the legend on the left side of that graph we see drag: 1, 0.9, 0.8, 0.55, 0.25 → diminishing trend of drag

this is another way of saying "the more slippery..."

Therefore the lower the drag the higher the vertical stretch, i.e. the distance traveled after the break was applied.