

6. [15 points] Kiki is beginning to experiment with time travel. She is sending her old math notebooks through time to test her machine. The machine is not working the way she intended:

- When a notebook of mass m kg is put into the machine, it travels in time $y = g(m)$ years (positive y means travel into the future, and negative y means travel into the past).
- Kiki's level of irritation while putting notebooks into her time machine, I , measured in frustrits (a unit of irritation) is a **linear** function of m , the mass, in kg, of the notebook she puts into the machine (i.e. $I = f(m)$ for some function f).

a. [6 points] Give practical interpretations of the following:

- $f^{-1}(1) = \frac{4}{3}$ means Kiki's irritation level is 1 frustrit when she puts a notebook of mass $\frac{4}{3}$ kg into the machine.
- $g(4) = -3$ means that a 4kg notebook travels 3 years into the past when it's put into the machine.

b. [6 points] For each of the following composition of functions, give a practical interpretation of the composition or explain why the expression does not make practical sense.

- $f(g(5))$ is nonsense. The input of f (kg) is incompatible with the output of g (years).
- $f(g^{-1}(2))$ is Kiki's irritation level in frustrits when she puts a notebook into the machine and it travels into the future 2 years.

c. [3 points] If a notebook of mass 4 kg is put into the machine, Kiki's irritation level is 3 frustrits, and if a notebook of 7 kg is put into the machine, Kiki's irritation level is 8 frustrits. Using this information, find a formula for the function f .

$$f(m) = \frac{5}{3}(m - 4) + 3$$

Solution: The slope is

$$\frac{8 - 3}{7 - 4} = \frac{5}{3}.$$

Using point-slope form, we have $f(m) = \frac{5}{3}(m - 4) + 3$.