MASSACHUSETTS INSTITUTE OF TECHNOLOGY
The Blended Learning Open Source Science and Math Studies Initiative (BLOSSOMS)
The Art of Approximation in Science and Engineering:
How to Whip Out Answers Quickly
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Exercise 1
What is 29 times 31? Don't use a calculator or the standard procedure for multiplying numbers on paper, which is tedious!

Exercise 2
Estimate
3/17 as a percentage without using long division or a calculator.

Exercise 3
Say we have a free-swinging pendulum. Think about what characteristics of the objects involved or their environment will determine the period of one round-trip swing. Come up with an equation for the period in terms of these characteristics. If you're having trouble getting started, you can assume that the period (in units of s) depends only on the length of the pendulum L (m) and the gravitational acceleration g (m/s^2).

Exercise 4
How close can you get to a black hole without being sucked in? Again, think about what physical parameters you need, either about the universe (like the role g played in the pendulum example) or about the object in question (like the role length played in that example). Here is a hint: Use

• G (gravitational constant), units of m^3 /(kg·s^2)
• M (mass of black hole), units of kg
• c (speed of light), units of m/s