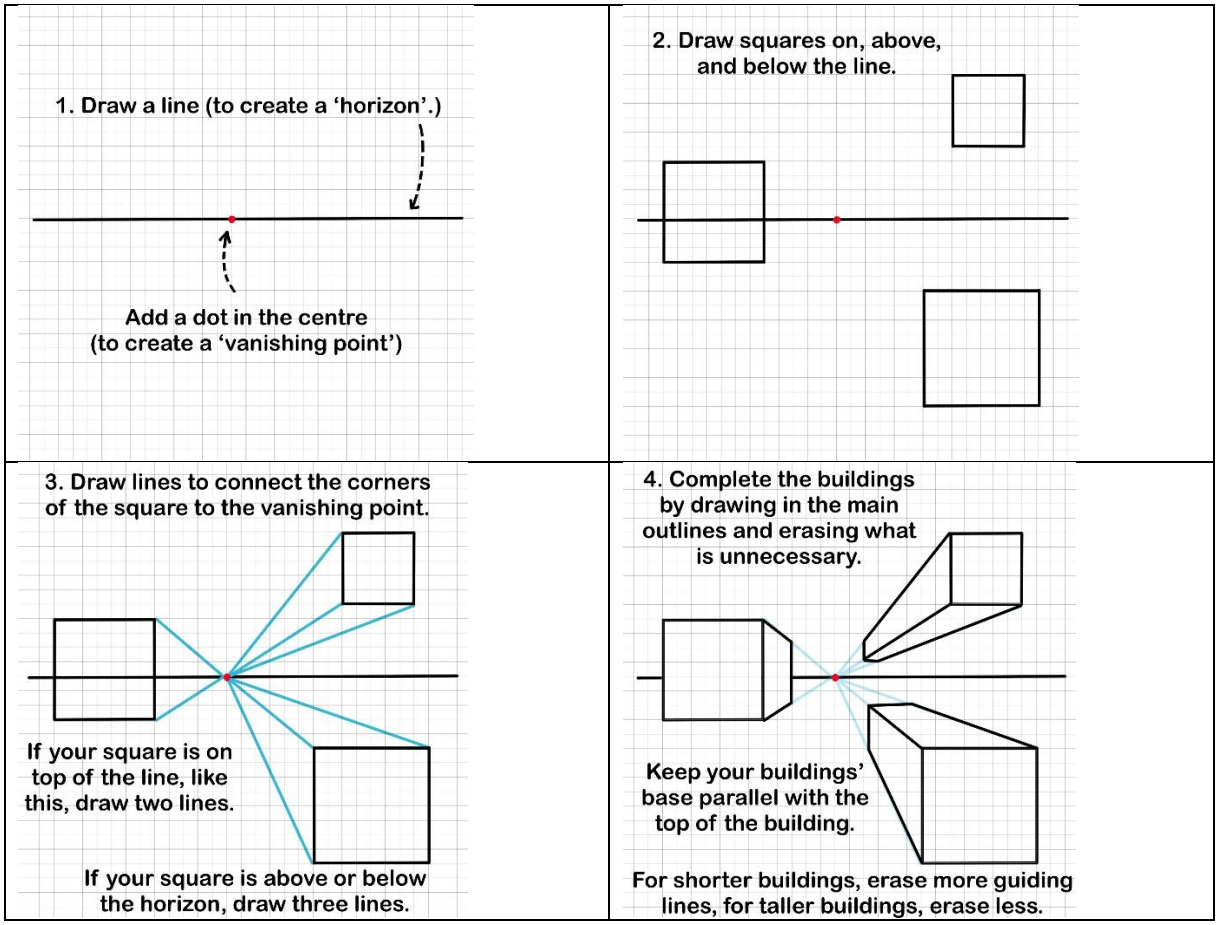
Name: _____

Class: _____ Date: _____

Standing Tall and Strong

An activity of "Shaken but still standing strong".

1) Read "Shaken, but still standing strong" (pages 18–19, *What's Up* February 2024). Follow the steps below to draw some tall 3D structures. Work in pairs.



Try it out here!

2) Fill in the following cloze passage based on the article you have read.

In Japan, earthquake-resistant building designs are essential due to the (a) _____ seismic activity in the region. Japanese architects have adopted various (b) _____ to make buildings earthquake-resistant.

Firstly, flexible building materials are used. Many modern buildings in Japan use materials like concrete reinforced with steel, which can (c) _____ without breaking, and bamboo for smaller structures due to its lightweight (d) _____.

Secondly, dampers are used to (e) _____ earthquake energy instead of resisting it. These include oil dampers that use fluid resistance and soft steel dampers that stretch to (f) _____ vibrations. For example, the Roppongi Hills Mori Tower have over 600 dampers that effectively absorb seismic energy, keeping the building stable during earthquakes.

Another (g) _____ used is the base isolation system. Introduced since the 1980s, these systems cushion buildings from the ground by (h) _____ the base from its foundation using springs or layers of steel and rubber.

Buildings like the Tokyo Skytree employ a (i)_____ with multiple segments and an independent concrete pillar at its core. This pillar is framed with oil dampers that counter vibrations during earthquakes, (j) _____ the tower's movement by half.

3) Challenge: build a strong tower
   Let's see if we can apply our knowledge of earthquake-resistant strategies to design and build a strong tower!

Materials

- Any recyclable materials like cardboard, toothpicks, paper, straws, etc.
- Glue, tape, scissors
- Small weights (e.g. coins, marbles, pebbles, etc.)
- A large tray filled with "soft" material like sand or rice to simulate the ground

Instructions

- In groups of 4-5, design and build a tower using the materials you have collected. Incorporate at least two earthquake-resistant features you have learned about from the article (e.g. flexible materials, dampers, base isolation, etc.)

- Test your tower by placing it on the tray containing the soft material. (In addition, you can place a phone on vibration or a handheld massager on the surface). Time the duration of the earthquake (say, 30 seconds). When the simulation is running, gradually add weights to the top of your tower. Record the maximum weight your tower can hold before collapsing.

4) Have a friendly match with other groups to see which tower stands the strongest.

5) Reflect on the design elements that contributed to your towers' stability. What made the towers strong? In what ways was it challenging to build? How did you overcome design problems? What adjustments/improvements did you make?