TUNNELWORKS
KS4 MATHS LESSON 3 WORKSHEET
GRAPHS Y = MX + C

Barges will take spoil (waste soil and rock from the Thames Tideway Tunnel) away from each foreshore construction site. This keeps lorries off the road and creates less noise for people who live and work nearby. However, parts of the River Thames are tidal, so some sites will have shallow water at some times of day. The best barge is one that won't sit too deep in the water and is quick to load. This will allow more barges to visit each day, if needed.

Task 1: Which two barges can visit a foreshore site with a minimum depth of 2.4m at low tide?
(The draft is the depth of water the barge needs to float.)

- Use the table below to draw four straight line graphs of the form y = mx + c, from 0 to 60 tonnes of spoil.
- Identify the two barges that will float in 2.4m of water when loaded with 50 tonnes of spoil.

Barge	A	B	C	D
Draft when empty	1m	1.5m	1m	2.1m
Additional draft per 10 tonnes of load	0.2m	0.1m	0.3m	0.1m

Task 2: The two barges that are suitable each take different times to dock and load. The faster this is done, the more trips a barge can make during the time the site is allowed to be open, from 8am to 6pm.

- Use the table below to draw two more straight line graphs, from 0 to 50 tonnes of soil. Remember to include the time to dock AND undock.
- Use your graphs to help you calculate how many times each type of barge could dock, load and undock during one working day at the site. The first barge can begin to dock at 8am. Remember to round down to the nearest whole number.

Barge	X	Y
Time to dock OR undock	15 mins	10 mins
Time to load 10 tonnes of spoil	10 mins	15 mins

Task 3: How will spring tides affect spoil removal?

Spring tides happen once a month at the time of the full moon. During a Spring tide, the high tide is higher than normal and low tide is even lower. At Spring tide, for three days the barge cannot dock between 2pm and 4pm because of the low water. How many barge loads will be missed? Remember that a barge cannot finish loading or undocking after 2pm, or start before 4pm. Round down to the nearest whole number.

Task 4: Which new barge design is the best upgrade?

The company that makes barge X announces two new designs, the X1 and X2. Which design is the most efficient upgrade to the original barge X, above? Draw two new lines on your graph for barge X to help you decide.

Barge	X1	X2
Time to dock OR undock	18 mins	14 mins
Time to load 10 tonnes of spoil	7 mins	8 mins