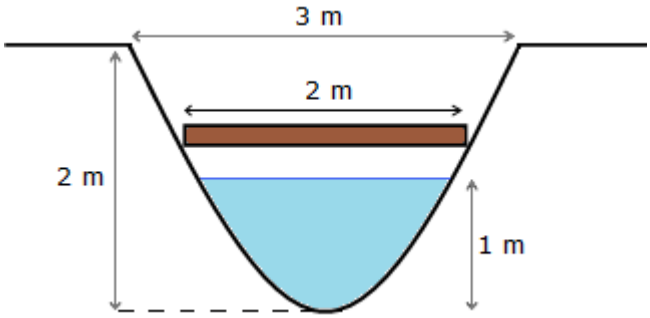
Y11 Context Graphs Practice #6

1. A parabola-shaped ditch is 3 metres wide and two metres deep.

   It is filled with water to a depth of 1.2 metres.

   If a two metre wide plank is placed across the ditch, will it be above the water?

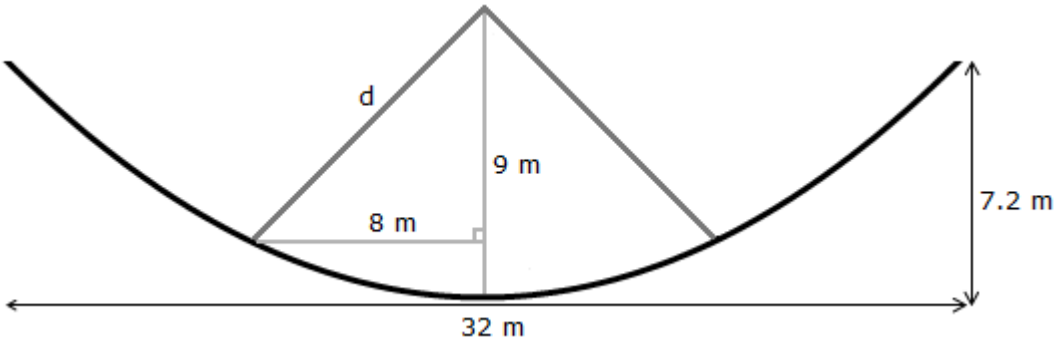


2. Radio telescopes are parabolic. In this case the dish is 32 metres across, with a depth of 7.2 metres.

   The supports for the receiver are 9 metres above the centre.

   The supports are placed so that their bases are 8 metres from the centre horizontally.

   Using your knowledge of parabolas calculate the length of the supports, d.



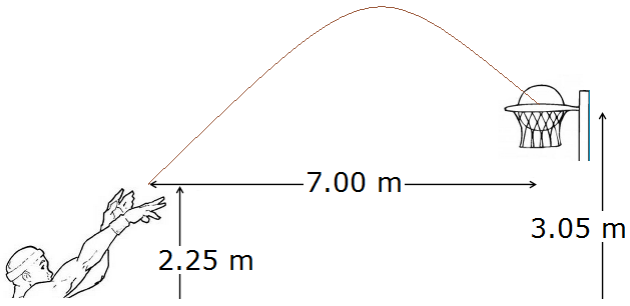
3. (Extension)

   A basketball has the ball 7 m from the hoop when he shoots it from a height of 2.25 m.

   The hoop is 3.05 m from the ground.

   Write an equation for a (parabolic) flight of the basketball that will put it through the hoop.

   Note, the ball needs to be heading quite strongly down at the hoop to go through, or it will bounce off the rim.



Answers: Y11 Context Graphs Practice #6

1. $h = k\,x(x - 3)$ models the ditch – with the left top of it being (0, 0)

   The deepest point is then (1.5, $^{-}2$), so $^{-}2 = k$ 1.5 (1.5 – 3), so $k = {}^{8}/_{9}$

   Ditch starts at x = 0.5, as it extends 1 m either side of 1.5 middle point

   $h = {}^{8}/_{9} \times 0.5\ (0.5 - 3) = {}^{-10}/_{9}$, which is below the water (at $^{-9}/_{9}$)

   Or

   $h = k\,x^2 - 3$ models the ditch – with ground level in the centre being (0, 0)

   $k = {}^{8}/_{9}$ as $0 = k\ 1.5^2 - 3$ using the top right of ditch being (1.5, 0)

   Putting in x = 1, to get right side of plank, as the 2m plank goes ±1 m from centre

   $h = {}^{8}/_{9}\ 1^2 = {}^{8}/_{9}$ so below the water at 1 m.

2. $h = k\,x^2$ models the dish – with the centre being (0, 0)

   The outer point of the dish is (16, 7.2), so $7.2 = k \times 16^2$, so $k = {}^{9}/_{320} = 0.028125$

   Finding the height above the ground at 8 m from the centre: $h = 0.028125 \times 8^2 = 1.8$

   The vertical distance from the horizontal bar to the top of the supports is 9 – 1.8 = 7.2

   Using Pythagoras, $d^2 = 8^2 + 7.2^2$, so d = 10.76 m

3. As given there is not enough information, so we need to make at least one assumption.

   Let the flight have it at 2.25 m again 7.8 metres out, $h = k\,x(x - 7.8) + 2.25$

   Goes through (7, 3.05), so $3.05 = k \times 7\ (7 - 7.8) + 2.25$, so $k = {}^{-1}/_{7}$

   $h = {}^{-1}/_{7}\,x(x - 7.8) + 2.25$ (note: this is only one possible answer)

   Check at midpoint, 3.9 m, that height is more than 1.3 m over net, so high enough.

   Note different assumptions will give different results for this question.