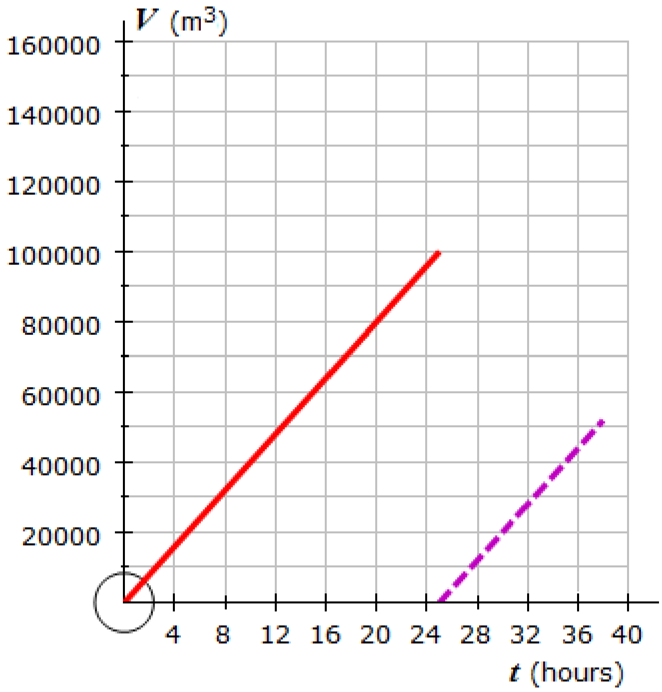
Y11 Context Graphs Practice #4

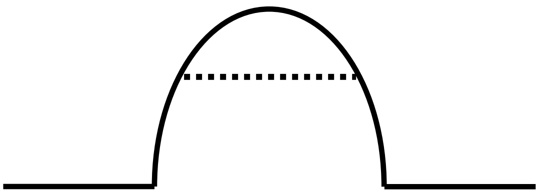
1. A reservoir holds 150 000 m^3 of helium.

   An airship that needs 100 000 m^3 of helium is filled up from the reservoir. The solid line opposite shows how full it is after *t* hours.



a. Write an equation for, V, the volume of helium left in the reservoir after *t* hours. Graph that relationship

b. Another blimp starts filling as soon as the first finishes (dotted line). Write the equation for how full it is after *t* hours.



2. A rabbit hutch is built so each support strut has the equation:

   $h = 0.25\, x\, (32 - x)$

   where h is hutch's height in centimetres

a. How wide is the hutch at the base?

b. What is the hutch's maximum height?

c. A bar 20 cm long goes across the strut to keep it firm, parallel to the ground (shown dotted). How high is that bar off the ground?

3. An engineer needs to build a tunnel. He chooses a parabola, since it supports its own weight properly.

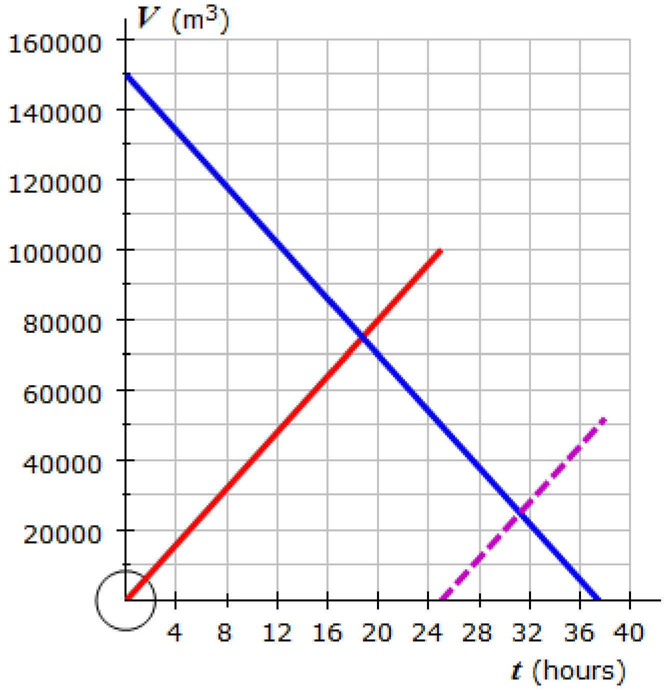
   The width base to base of the tunnel needs to be 12 metres.

   The hieght within 1 m of the edge needs to be at least 2 m.

   Write an equation for the parabola, and use that to find how high the highest point will be.

Answers: Y11 Context Graphs Practice #4

1.



a The blimp filling gets 80 000 m^3 in 20 hours, so must be filling at 4 000 m^3/hr.

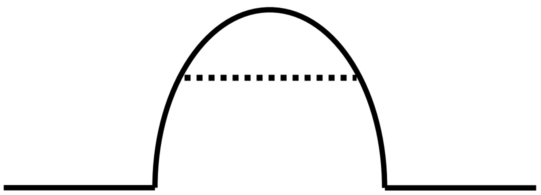
The reservoir starts with 150 000 m^3 and goes down at the rate the blimp fills:

V = −4000*t* + 140 000 **$0 \le t \le 25$**

The line is shown

b This fills at the same rate, but after 100 000 m^3 has already been used:

B = 4000*t* − 100 000 **$25 \le t \le 38$**



2. $h = 0.25\, x\, (32 - x)$

a Intercepts are $x = 0$ and $x = 32 \Rightarrow$ **32 cm**

b At middle, $x = 16$, $h = 0.25 \times 16 \times (32 - 16)$

= **64 cm high**

c The bar is 20 cm long, and so by symmetry it extends 10 cm either side of the midway point, which is $x = 16$. Therefore it ends at $x = 6$ and $x = 26$

$h = 0.25 \times 6 \times (32 - 6)$ = **39 cm high**

3. Can't use turning point method, since we don't know the turning point, so we use intercept method:

With left corner at (0, 0), $h = k\; x\,(x - 12)$. Put in the known value of (1, 2) and we get

$2 = k \times 1 \times (1 - 12)$, so $k = {}^{-2}/_{11}$. $\boldsymbol{h = {}^{-2}/_{11}\, x\,(x - 12)}$

Or if centre of tunnel is (0, 0), gives $h = k\,(x + 6)(x - 6)$. Put in known value of (5, 2) which is 1 from edge $2 = k \times (5 + 6)(5 - 6)$, so $k = {}^{-2}/_{11}$. $\boldsymbol{h = {}^{-2}/_{11}\,(x + 6)(x - 6)}$

The highest point will be at $x = 6$ for first option, or $x = 0$ for second.

$h_{max} = {}^{-2}/_{11} \times 6 \times (6 - 12) = \boldsymbol{{}^{72}/_{11}}$ **(6.545) metres high**