Essentials Mathematics
Unit 3

Semester 1 2017

Investigation #1

Angles in Mining

Baldivis Secondary College

***** START OF IN CLASS SECTION*****

Name: _____ Date: _____

Total Time: ***50*** *minutes*

Total Working: *55 minutes*

Equipment: *The Take-Home section of this investigation, Scientific Calculator*

Full working out must be shown to get full marks.
Attempt all questions

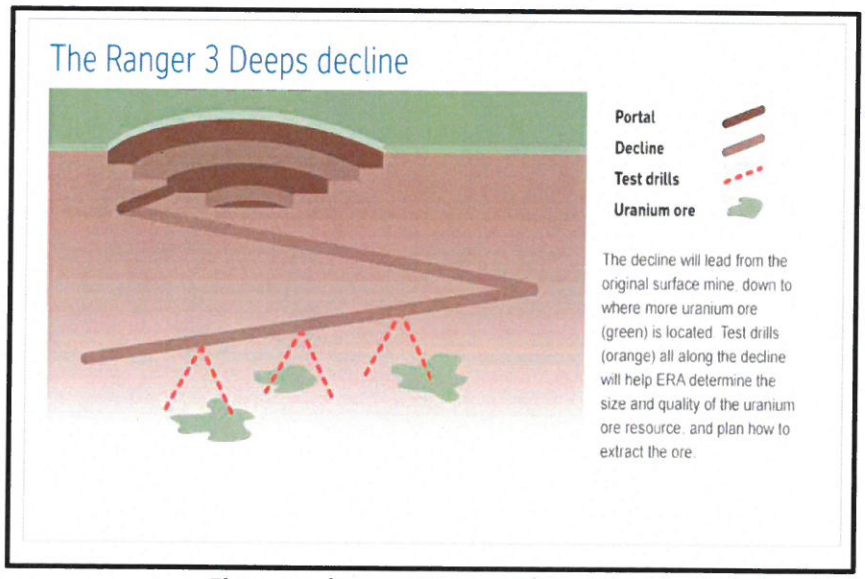


Figure 1 The Ranger 3 Deeps Decline

Question One. Figure 1 shows the proposed tunnels that will be drilled in order to access the uranium containing ore. What would be the impact if the angle of decline of the tunnels were too steep? Give two ideas.

(two marks)

- Heavy machines or Haul trucks wouldnt be able to stop
- Ground failures

Any reasonable Answer

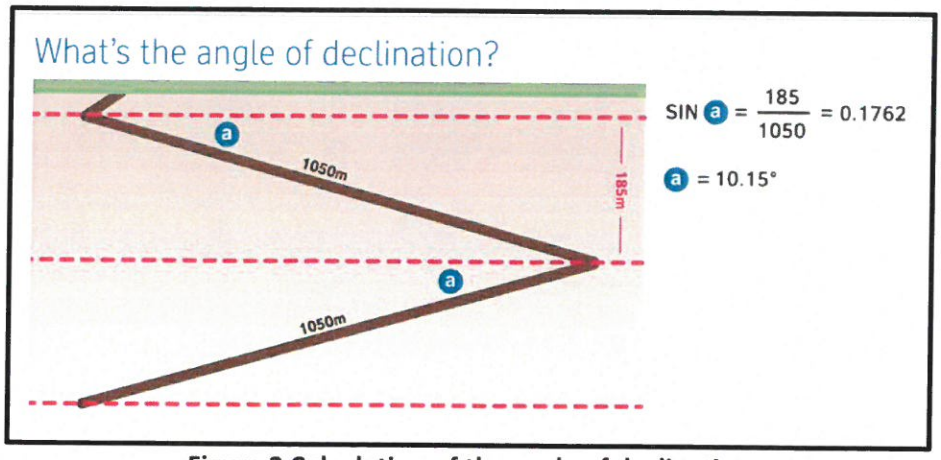


Figure 2 Calculation of the angle of declination

Question Two. Figure 2 shows the method that is used to calculate the angle of declination for two tunnels that are 1050m long which go down 185m each. What would be the new angle of declination if the tunnels were each100m longer?

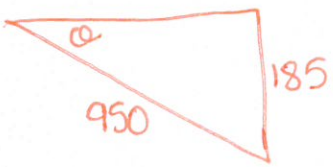
(three marks)

$\tan\theta = \frac{185}{1150}$ ✓

$\theta = 9.14^\circ$ ✓

Question Three. What would be the new angle of declination if the tunnels were 100m shorter?

(three marks)

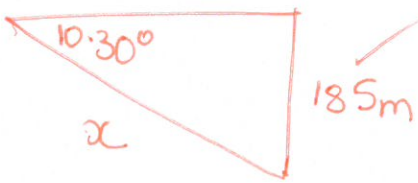


$\tan\theta = \frac{185}{950}$ ✓

$= 11.01^\circ$ ✓

Question Four. The maximum angle of declination that is a) safe for the trucks, and b) economical for the trucks is 10.30°. What length do the two tunnels each need to be in order for this condition to be met?

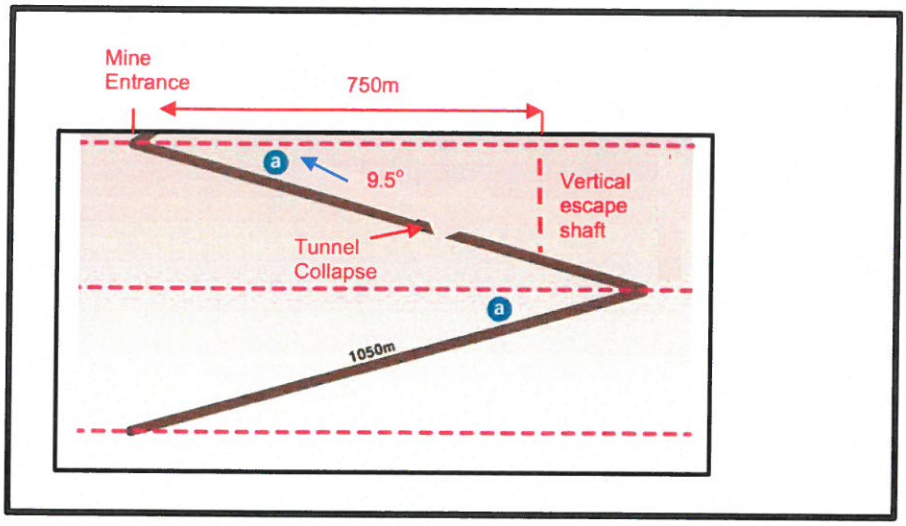
(four marks)



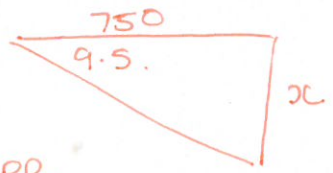
$\sin 10{\cdot}30 = \frac{185}{x}$ ✓

$x = \frac{185}{\sin 10{\cdot}30}$ ✓

$= 1034.67\text{m}$ ✓



Question Five. The tunnel that declines at 9.5° has collapsed, trapping the miners inside. The rescue team decide to drill a vertical escape shaft from a position 750 m horizontally from the mine entrance. How deep does the rescue shaft need to be to meet the declining tunnel? HINT: Draw a diagram to match this situation. Answer correct to 2 decimal place. (three marks)



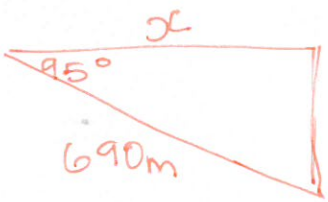
$\tan = \frac{opp}{adj}$

$\tan 9.5° = \frac{x}{750}$

$x = \tan 9.5° \times 750$

$x = 125.51\,m$

Question Six. If the tunnel collapse is 690m down the decline tunnel at 9.5° how far horizontally from the mine entrance is the actual tunnel collapse? (three marks)



$\cos = \frac{adj}{hyp}$

$\cos 9.5° = \frac{x}{690}$

$x = \cos 9.5° \times 690$

$= 680.54\,m$

Question Seven. By drilling the vertical escape shaft and additional 50 m horizontally from the tunnel the rescue team have to drill quite a bit deeper. Why do you think the rescue team choose to drill this extra depth and distance from the mine entrance? (two marks)

- to Avoid further collapse
- Any reasonable Answer
- make sure well past the weakened area for safe extraction of workers.

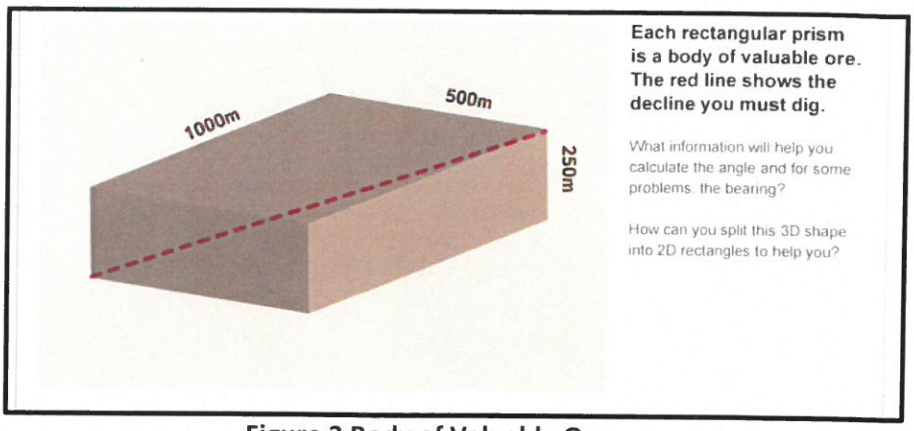
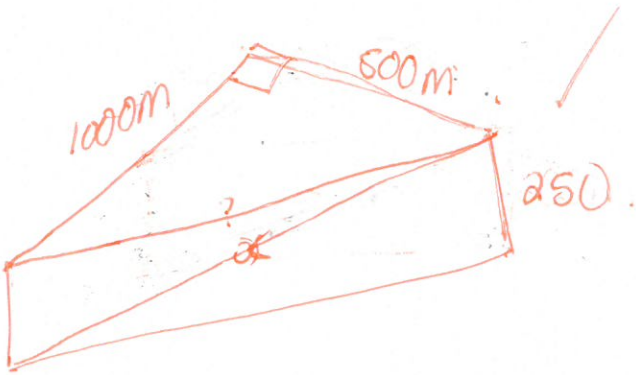


Figure 3 Body of Valuable Ore

Figure 3 shows an approximation of a body of valuable ore.

Question Eight. Calculate the angle of declination shown as the dotted line in Figure 3.

(five marks)



$c^2 = a^2 + b^2 =$

$= 1000^2 + 500^2$ ✓

$c = \sqrt{1250000}$

$= 1118.03\text{m}$ ✓

$c^2 = a^2 + b^2$

$= (1118.03)^2 + 250^2$ ✓

$c = \sqrt{1312500}$

$= 1145.64\text{m}$ ✓

or

$\tan\theta = \frac{opp}{adj}$

$= \frac{250}{1118.03}$

$= 12.60^\circ$

$\sin\theta = \frac{opp}{hyp}$

$= \frac{250}{1145.64}$

$= 12.60^\circ$

****** END OF THIS SECTION******