**NZQA**

**Approved**

Achievement standard: 91259 Version 2

Standard title: Apply trigonometric relationships in solving problems

Level: 2

Credits: 3

Resource title: Build a bike

Resource reference: Mathematics and Statistics VP-2.4 v2

Vocational pathway: Manufacturing and Technology

|  |  |
| --- | --- |
| Date version published | February 2015 Version 2  To support internal assessment from 2015 |
| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number A-A-02-2015-91259-02-8192 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.  Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

Achievement standard: 91259

Standard title: Apply trigonometric relationships in solving problems

Level: 2

Credits: 3

Resource title: Build a bike

Resource reference: Mathematics and Statistics VP-2.4 v2

Vocational pathway: Manufacturing and Technology

Learner instructions

# Introduction

This assessment activity requires you to apply trigonometric relationships to calculate the quantity of steel tubing needed to build the frame for a mini-bike.

You are going to be assessed on how you apply trigonometric relationships, using extended abstract thinking, to devise a strategy and develop a chain of logical reasoning to make a recommendation on the quantity of steel tubing needed to build the frame for a mini-bike.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions and modify them if necessary to suit their learners.

# Task

Learners at different schools build mini-bikes to race in national championships held each year at the Manfeild race circuit in Feilding. Each mini-bike is constructed from different quantities of a variety of materials.

You will calculate some of the quantities needed for a mini-bike frame, in order to make a recommendation to a supplier.

Diagram 1 shows the side view of the bike frame. The frame is made from two sets of steel tubing that are 200 mm apart and joined in four places.

All of the tubing is parallel except for the pipes from the front steering fork to the back axle. Viewed from above, these pipes are shaped as shown in Diagram 2. Other data you may need is also provided.

Write a report to the supplier which includes the following recommendations regarding material for the mini-bike:

* the length of tubing from the front fork to the back axle (shown in stripes on the diagram)
* the area of the triangle ABC, which is to be covered with hard plastic and painted
* the length of steel tubing required for the side view of the frame, as shown in the diagram.

You need to clearly communicate your method using appropriate mathematical statements so that the supplier can easily verify the total length of tubing and the area of hard plastic.

## Diagram 1: Side view of a bike frame

Wheelbase 800 mm

150 mm

Seat

Height

500 mm

300 mm

100 mm

57º

30º

A

B

C

## Diagram 2

* the triangle formed by the steering-fork pipes and back axle is not an isosceles triangle
* the length of AC is 320 mm
* the length of BC is 225 mm
* the distance behind B (the seat) is 210 mm
* the angle at the back axle is 8°
* the angle formed by the pipe running under the seat and the upper pipe from the steering fork to the back axle is 37°
* the lower pipe supports the engine. This pipe and the pipe rising to the seat at B are half the length of the pipe running under the seat to A.

Vocational Pathway Assessment Resource

Achievement standard: 91259

Standard title: Apply trigonometric relationships in solving problems

Level: 2

Credits: 3

Resource title: Build a bike

Resource reference: Mathematics and Statistics VP-2.4 v2

Vocational pathway: Manufacturing and Technology

Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to apply trigonometric relationships, using extended abstract thinking, to calculate the total length of steel tubing required to build a mini-bike frame.

# Conditions

Learners will work independently to complete this activity.

# Resource requirements

Learners need access to appropriate technology.

# Additional information

Make sure learners are familiar with any context-specific vocabulary used in this resource.

# Assessment schedule: Mathematics and Statistics 91259 – Build a bike

|  |  |  |
| --- | --- | --- |
| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner applies trigonometric relationships in solving problems by:   * selecting and using methods * demonstrating knowledge of trigonometric concepts and terms * communicating using appropriate representations   Any appropriate and correct rounding is acceptable (including truncation) and does not need to be stated. Some evidence of correct units is required.  For example:  The learner finds the length of a pipe from the front fork to the back axle and finds the area of triangle ABC or finds the area of triangle ABC and the length of AB.  *The examples above are indicative of the evidence that is required.* | The learner applies trigonometric relationships, using relational thinking, in solving problems by involving one or more of:   * selecting and carrying out a logical sequence of steps * connecting different concepts or representations * demonstrating understanding of concepts * forming and using a model   and also relating findings to the context, or communicating thinking using appropriate mathematical statements  Any appropriate and correct rounding is acceptable (including truncation) and does not need to be stated. Correct units are required.  For example:  The learner uses all the information to determine the area of hard plastic to be painted and the length of steel tubing required to make the mini-bike frame.  *The examples above are indicative of the evidence that is required.* | The learner applies trigonometric relationships, using extended abstract thinking, in solving problems by involving one or more of:   * devising a strategy to investigate or solve a problem * identifying relevant concepts in context * developing a chain of logical reasoning, or proof   and also using correct mathematical statements, or communicating mathematical insight  Any appropriate and correct rounding is acceptable (including truncation) and does not need to be stated. Correct units are required.  For example:  The learner devises a strategy to find the quantities of hard plastic and steel tubing, taking into consideration the curved sections, to make the frame for the mini-bike.  *The examples above are indicative of the evidence that is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.