

## Achievement Standard

**Subject Reference** Mathematics and Statistics 3.4

**Title** Use critical path analysis in solving problems

**Level** 3      **Credits** 2      **Assessment** Internal

**Subfield** Mathematics

**Domain** Geometry

**Status** Registered      **Status date** 4 December 2012

**Planned review date** 31 December 2019      **Date version published** 17 November 2016

This achievement standard involves using critical path analysis in solving problems.

### Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none"> <li>Use critical path analysis in solving problems.</li> </ul>	<ul style="list-style-type: none"> <li>Use critical path analysis, with relational thinking, in solving problems.</li> </ul>	<ul style="list-style-type: none"> <li>Use critical path analysis, with extended abstract thinking, in solving problems.</li> </ul>

### Explanatory Notes

Version 2 was republished in January 2017 to correct the introductory statement.

- This achievement standard is derived from Level 8 of *The New Zealand Curriculum*, Learning Media, Ministry of Education, 2007; and is related to the achievement objective:
  - Develop network diagrams to find optimal solutions, including critical paths in the Mathematics strand of the Mathematics and Statistics Learning Area. It is also related to the material in the *Teaching and Learning Guide for Mathematics and Statistics*, Ministry of Education, 2012, at <http://seniorsecondary.tki.org.nz>.

This standard is also derived from *Te Marautanga o Aotearoa*. For details of the *Marautanga* achievement objectives to which this standard relates, see the [Māori version](#) of the standard.

- Use critical path analysis in solving problems involves:
  - selecting and using methods
  - demonstrating knowledge of concepts and terms
  - communicating using appropriate representations.

*Relational thinking* involves 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 a context, or communicating thinking using appropriate mathematical statements.

*Extended abstract thinking* involves 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
- forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight.

- 3 Problems are situations that provide opportunities to apply knowledge or understanding of mathematical concepts and methods. Situations will be set in real-life or mathematical contexts.
- 4 Methods include a selection from those related to:
  - precedence tables
  - network diagrams
  - critical events
  - scheduling
  - float times.
- 5 Conditions of Assessment related to this achievement standard can be found at [www.tki.org.nz/e/community/ncea/conditions-assessment.php](http://www.tki.org.nz/e/community/ncea/conditions-assessment.php).

### Quality Assurance

- 1 Providers and Industry Training Organisations must have been granted consent to assess by NZQA before they can register credits from assessment against achievement standards.
- 2 Organisations with consent to assess and Industry Training Organisations assessing against achievement standards must engage with the moderation system that applies to those achievement standards.

## Paerewa Paetae

<b>Aronga</b>	Pāngarau 3.4			
<b>Ingoa</b>	Te whakamahi tikanga kimi ara tino whaitake hei whakaoti rapanga			
<b>Kaupae</b>	3	<b>Whiwhinga</b>	2	<b>Aromatawai</b> Ā-waho
<b>Marau akoranga</b>	Te Marautanga o Aotearoa			
<b>Kokonga akoranga</b>	Pāngarau			
<b>Mana rēhita</b>	Kua rēhitatia	<b>Te rā i mana ai</b>	4 Hakihea 2012	
<b>Te rā e arotakengia ai</b>	31 Hakihea 2018	<b>Te rā i puta ai</b>	17 Whiringa-ā-rangi 2016	

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### Te Hononga ki te Marautanga

I ahu mai tēnei paerewa paetae i te Taumata 8 o *Te Marautanga o Aotearoa*, i whakaputaina e Te Pou Taki Kōrero i te tau 2008.

### Whāinga Paetae

*Te Taurangi me te Tuanaki, Te Taurangi me te Pānga*

5 *Ka tuhi hoahoa rauara hei whiriwhiri i te otinga e tino whaihua ana, ka whakamārama hoki i ngā ara matua.*

E hono ana ki te Papa Whakaako mō te Pāngarau kei te pae tukutuku nei:

<http://tmoa.tki.org.nz/Te-Marautanga-o-Aotearoa-Taumata-Matauranga-a-Motu-Ka-Taea>

### Te Hononga ki *The New Zealand Curriculum* (NZC)

I ahu mai hoki tēnei paerewa paetae i *The New Zealand Curriculum*. Mō ngā kōrero e pā ana ki ngā whāinga paetae o te NZC e hāngai ana ki tēnei paerewa, tirohia te [putanga reo Pākehā](#) o te paerewa.

### Te Hononga ki ngā Paearu Aromatawai

Arā ngā Paearu Aromatawai mō tēnei paerewa paetae, kei te:

<http://tmoa.tki.org.nz/Te-Marautanga-o-Aotearoa-Taumata-Matauranga-a-Motu-Ka-Taea>

**Paerewa Paetae**

<p><b>Paetae</b> Te whakamahi tikanga kimi ara tino whaitake hei whakaoti rapanga.</p>	<p>Hei tohu i te paetae:</p> <ul style="list-style-type: none"> <li>• Ka whiriwhiri, ka whakamahi i ētahi tikanga whānui hei whakaoti rapanga.</li> <li>• Ka whakaatu mōhiotanga ki ngā huatau me ngā kupu e hāngai ana hei whakaoti rapanga.</li> <li>• Ka tūhono i ētahi huatau rerekē.</li> <li>• Ka whakamārama i ngā otinga mēnā kotahi, e rua rānei ngā mahi o roto i te tikanga i whakamahia ai.</li> </ul>
<p><b>Kaiaka</b> He kaiaka te whakamahi tikanga kimi ara tino whaitake hei whakaoti rapanga.</p>	<p>Hei tohu i te kaiaka:</p> <ul style="list-style-type: none"> <li>• Ko te whakaaro tūhonohono te mea nui. Arā, kia kotahi, nui ake rānei o ēnei: <ul style="list-style-type: none"> <li>– ka whiriwhiri, ka whakatutuki raupapatanga mahi arorau hei whakaoti rapanga.</li> <li>– ka tūhono i ētahi huatau rerekē, i ētahi whakaahuahanga rerekē rānei hei whakaoti rapanga.</li> <li>– ka whakaatu māramatanga ki ngā huatau e hāngai ana</li> <li>– ka hanga, ka whakamahi tauira.</li> </ul> </li> <li>• Ka tūhono i ngā otinga ki tētahi horopaki, ka whakamahi rānei i ngā kīanga pāngarau hei whakawhitiwhiti whakaaro.</li> </ul>
<p><b>Kairangi</b> He kairangi te whakamahi tikanga kimi ara tino whaitake hei whakaoti rapanga.</p>	<p>Hei tohu i te kairangi:</p> <ul style="list-style-type: none"> <li>• Ko te whakaaro waitara te mea nui. Arā, kia kotahi, nui ake rānei o ēnei: <ul style="list-style-type: none"> <li>– ka waihanga rautaki hei tūhura, hei whakaoti rānei i tētahi rapanga.</li> <li>– ka tautohu i ngā huatau e hāngai ana ki te horopaki.</li> <li>– ka whakaputa i tētahi raupapatanga whakaaro arorau, i tētahi hāponotanga rānei.</li> <li>– ka hanga whakawhānuitanga.</li> </ul> </li> <li>• Ka whakamahi i ngā kīanga pāngarau tika hei whakawhitiwhiti i te aroā pāngarau.</li> </ul>

**Kōrero Āpiti**

1 E whai ake nei ngā whakamārama o ngā tino kupu, kīanga rānei:

rapanga	Ko ngā āhuatanga o ia rā, ngā āhuatanga pāngarau rānei ka whai wāhi mai te whakamahinga o te mātauranga pāngarau, o ngā huatau pāngarau, o ngā tikanga pāngarau rānei.
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2 Kia taunga te ākonga ki ngā tikanga kimi ara tino whaitake:

- ngā tūtohinga raupapatanga kaupapa
- ngā hoahoa rauara
- ngā kaupapa tino whaitake
- te wātaka hei whai atu
- te hononga o te hoahoa rauara ki te wātaka: āhea tatari ai, āhea kōkiri ai

**Kuputaka:**

aroā pāngarau	mathematical insight
kaupapa tino whaitake	critical events
kīanga pāngarau	mathematical statement
tūtohinga raupapatanga kaupapa	precedence tables
whakaaro arorau	logical thinking, reasoning
whakaaro tūhonohono	relational thinking
whakaaro waitara	abstract thinking

**ātari Kounga**

- 1 Me mātua whakamana ngā Kaituku Akoranga me ngā Whakahaere Whakangungu Ahumahi e te Mana Tohu Mātauranga o Aotearoa ka rēhita ai i ngā hua ka puta mai i ngā aromatawai ki ngā paerewa paetae.
- 2 Ko ngā Kaituku Akoranga me ngā Whakahaere Whakangungu Ahumahi kua mana, ā, e aromatawai ana i ā rātou hōtaka ki ngā paerewa paetae, me uru rātou ki ngā pūnaha whakaōrite e tika ana mō aua paerewa paetae.

Ko te tohutoro ki te Mahere Whakamana, Whakaōritenga hoki

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