Achievement Standard

Subject Reference   Mathematics and Statistics 1.4

Title   Apply linear algebra in solving problems

Level   1   **Credits**   3   **Assessment**   Internal

Subfield   Mathematics

Domain   Algebra

Status   Registered   **Status date**   9 December 2010

Planned review date   31 December 2016   **Date version published**   12 December 2013

This achievement standard involves applying linear algebra in solving problems.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Apply linear algebra in solving problems.	• Apply linear algebra, using relational thinking, in solving problems.	• Apply linear algebra, using extended abstract thinking, in solving problems.

Explanatory Notes

1   This achievement standard is derived from Level 6 of *The New Zealand Curriculum,* Learning Media, Ministry of Education, 2007, and is related to the material in the *Teaching and Learning Guide for Mathematics and Statistics*, Ministry of Education, 2010 at http://seniorsecondary.tki.org.nz. The following achievement objectives taken from the Equations and Expressions, and Patterns and Relationships threads of the Mathematics and Statistics learning area are related to this standard:
   • form and solve linear equations
   • solve linear equations and inequations and simultaneous equations with two unknowns
   • relate graphs, tables, and equations to linear relationships
   • relate rate of change to the gradient of a graph.

   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.

2   *Apply linear algebra* involves:
   • selecting and using a range of methods in solving problems
   • demonstrating knowledge of algebraic concepts and terms

- communicating solutions which would usually require only one or two steps.

Relational thinking involves one or more of:
- selecting and carrying out a logical sequence of steps
- connecting different concepts and 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. The situation will be set in a real-life context.

4   The phrase 'a range of methods' indicates that evidence of the application of at least three different methods is required.

5   Students need to be familiar with methods related to:
- using formulae
- forming, graphing or manipulating linear models such as $C = 8 + 0.75t$ when solving problems
- comparing the rate of change to the gradient of a graph
- using simultaneous equations, inequations, or graphs when solving problems such as those involving simple linear programming.

6   Conditions of Assessment related to this achievement standard can be found at www.tki.org.nz/e/community/ncea/conditions-assessment.php.

Replacement Information
This achievement standard and AS91028 replaced unit standard 5238.

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.

      Consent and Moderation Requirements (CMR) reference   0233

Paerewa Paetae

Aronga   Pāngarau 1.4

Ingoa   Te whakamahi tikanga taurangi rārangi hei whakaoti rapanga

Kaupae   1   **Whiwhinga**   3   **Aromatawai**   Ā-roto

Marau akoranga   Te Marautanga o Aotearoa

Kokonga akoranga   Pāngarau

Mana rēhita   Kua rēhitatia   **Te rā i mana ai**   9 Hakihea 2010

Te rā e arotakengia ai   31 Hakihea 2016   **Te rā i puta ai**   12 Hakihea 2013

Te Hononga ki te Marautanga

I ahu mai tēnei paerewa paetae i te Taumata 6 o *Te Marautanga o Aotearoa*, i whakaputaina e Te Pou Taki Kōrero i te tau 2008.

Whāinga Paetae

Te Tau me te Taurangi, Te Whārite me te Kīanga
6   Ka tuhi, ka whakaoti whārite rārangi, tōrite rārangi, whārite pūrua, whārite taupū māmā, whārite tukutahi, kia rua ngā taurangi.

Te Tau me te Taurangi, Te Pānga me te Tauira
8   Ka tūhono i te kauwhata, te tūtohi me te whārite ki ngā pānga rārangi, pānga pūrua, pānga taupū māmā e kitea mai ana i ngā tauira tau me ngā tauira mokowā.
9   Ka tūhono i te pāpātanga o te whiti ki te rōnaki o tētahi kauwhata.

E hono ana ki te Papa Whakaako mō Pāngarau kei te pae ipurangi 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 Tikanga Aromatawai

Kei tēnei pae ipurangi ngā Tikanga Aromatawai mō tēnei paerewa paetae:
http://tmoa.tki.org.nz/Te-Marautanga-o-Aotearoa/Taumata-Matauranga-a-Motu-Ka-Taea.

Paerewa Paetae

Paetae Te whakamahi tikanga taurangi rārangi hei whakaoti rapanga.	Hei tohu i te paetae: • ka whiriwhiri, ka whakamahi i ētahi tikanga taurangi whānui hei whakaoti rapanga • ka whakaatu mōhiotanga ki ngā huatau taurangi me ngā kupu e hāngai ana • ka whakamārama i ngā otinga mēnā kotahi, e rua rānei ngā mahi o roto i te tikanga i whakamahia ai.
Kaiaka He kaiaka te whakamahi tikanga taurangi rārangi hei whakaoti rapanga.	Hei tohu i te kaiaka: • Ko te whakaaro tūhonohono te mea nui. Arā, kia kotahi, nui ake rānei o ēnei: – ka whiriwhiri, ka whakatutuki i te raupapatanga mahi arorau e hāngai ana – ka tūhono i ētahi huatau rerekē, ētahi whakaahuahanga rerekē rānei – ka whakaatu māramatanga ki ngā huatau e hāngai ana – ka hanga, ka whakamahi tauira. • Ko te tūhono i ngā otinga ki tētahi horopaki, te whakamahi rānei i ngā kīanga pāngarau hei whakawhitiwhiti whakaaro.
Kairangi He kairangi te whakamahi tikanga taurangi rārangi hei whakaoti rapanga.	Hei tohu i te kairangi: • Ko te whakaaro waitara te mea nui. Arā, kia kotahi, nui ake rānei o ēnei: – ka waihanga rautaki hei tūhura, hei whakaoti rānei i tētahi rapanga – ka tautohu i ngā huatau e hāngai ana ki te horopaki – ka whakaputa i tētahi raupapatanga whakaaro arorau, tētahi hāponotanga rānei – ka hanga whakawhānuitanga. • Ko te whakamahi kīanga pāngarau tika, te whakawhitiwhiti rānei i te aroā pāngarau.

Kōrero Āpiti

1   E whai ake nei ko te whakamāramatanga o ngā kupu whaitake, 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.
ētahi tikanga taurangi whānui	Kia toru, nui ake rānei ngā tikanga.

2   Kia taunga te ākonga ki ngā tikanga e whai wāhi mai ana:
   • te whakamahi ture tātai
   • te hanga, te tuhi kauwhata, me te rāwekeweke i ngā whārite rārangi, pērā i te $E = 8 + 0.75t$, hei whakaoti rapanga

- te tūhono i te pāpātanga o te whiti ki te rōnaki o te kauwhata
- te whakamahi whārite tukutahi, tōrite, kauwhata rānei hei whakaoti rapanga e whai wāhi mai ana te pānga rārangi.

Kuputaka:
whakaaro tūhonohono	relational thinking
whakaaro waitara	abstract thinking

He Kōrero mō te Whakakapi
Koinei me te paerewa paetae 91028 hei whakakapi i te paerewa 5238.

Tātari 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 whakarite e tika ana mō aua paerewa paetae.

Ko te tohutoro ki te Mahere Whakamana, Whakaōritenga hoki   0233