



PLACE LABEL HERE

Tasmanian Certificate of Education

**APPLIED SCIENCE –
TASMANIAN NATURAL RESOURCES**

Senior Secondary

Subject Code: TNR315109

External Assessment

2010

Time: Two hours

On the basis of your performance in this examination, the examiners will provide a result on the following criteria taken from the course statement:

- | | |
|--------------------|--|
| Criterion 2 | Develop, interpret and evaluate science experiments. |
| Criterion 4 | Demonstrate understanding of the application and impact of science in society. |
| Criterion 7 | Demonstrate knowledge and understanding of resource management. |
| Criterion 8 | Analyse, interpret and draw conclusions. |

Pages: 28

Questions: 13

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CANDIDATE INSTRUCTIONS

You **MUST** ensure that you have addressed **ALL** of the externally assessed criteria on this examination paper.

Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

No other printed material is allowed into this examination.

You should make sure you answer all parts within each question so that the criteria can be assessed.

All written responses must be in English.

Section A – Criterion 2

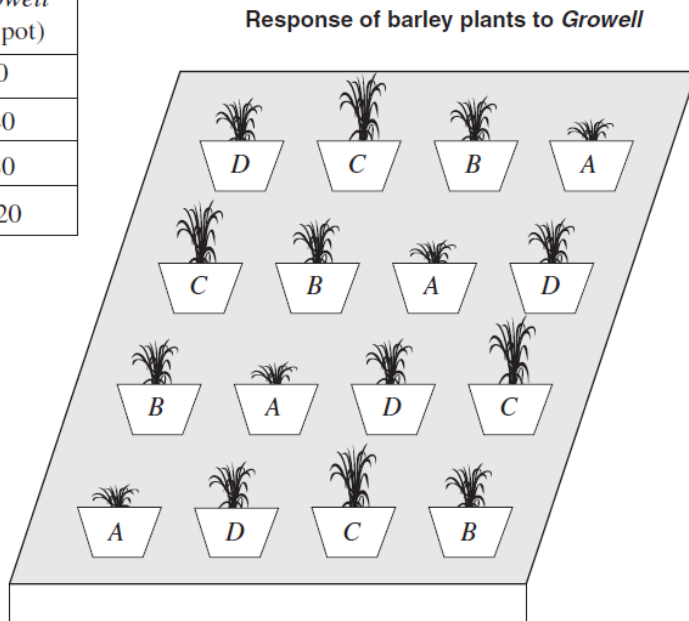
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It is recommended that you spend approximately **30 minutes** on this section.

Question 1

A student conducted an experiment in a glasshouse to determine the effect of a new fertiliser, *Growell*, on barley plants. Each pot contained ten seeds and the rate of *Growell* fertiliser applied is shown in the table.

<i>Treatment</i> (pot)	<i>Growell</i> (g/pot)
<i>A</i>	0
<i>B</i>	40
<i>C</i>	80
<i>D</i>	120



- (a) State **one** measurement the student may make to determine the effect of *Growell* on barley. (1 mark)

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Question 1 continues opposite.

Question 1 (continued)

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(b) Describe **two** ways that this student has increased the reliability of results by using this experimental design. (4 marks)

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(ii)

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(c) Discuss **four** factors that need to be considered before conducting this experiment in the field rather than in a glasshouse. (4 marks)

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(ii)

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Question 2

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An experiment was conducted to determine the effect of two fungicides, Dithane and Chlorothalanil, on a disease that affects the grain yield of chickpeas.

<i>Application rate (litres/ha)</i>	<i>Grain yield (tonnes/ha)</i>	<i>Total cost* (\$/ha)</i>
<i>Dithane</i>		
0.0	0.5	0
0.5	2.1	17
1.0	3.4	29
<i>Chlorothalanil</i>		
0.0	0.5	0
0.5	3.3	20
1.0	3.5	35

*Total cost (\$/ha) = Fixed application cost + cost of fungicide

- (a) What is the application rate of fungicide for the control in this experiment? (1 mark)

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- (b) Describe the role of the control in this experiment. (2 marks)

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- (c) Which fungicide, **and** at what rate, would you recommend the farmer use? Explain your choice. (2 marks)

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Question 2 continues opposite.

Question 2 (continued)

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(d) Explain **two** factors that a farmer should consider, in addition to the information provided from this experiment, before deciding to use a fungicide on chickpeas. (4 marks)

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Question 3

For a case study into an ‘Energy’ topic, a student studying Applied Science – Tasmanian Natural Resources decided to investigate the claims made by Green Fuel Systems International that the Australian-developed LPG Autogas system will help operators of heavy diesel-powered trucks reduce fuel bills by 20 percent. The invention uses a dual-phase induction system which introduces LPG Autogas into the air intake of diesel engines, to improve the diesel combustion process.

The student decided to collect data from several mining industry vehicles during their regular weekly use to determine if vehicles fitted with the new invention and using diesel mixed with LPG Autogas were 20 percent more efficient than vehicles using the standard diesel fuel.

The student thought that if simple ‘fuel consumption’ versus ‘kilometres travelled’ data was obtained, conclusive evidence would be supplied.

- (a) Write a suitable hypothesis for the student’s intended investigation. (3 marks)

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- (b) Describe **two** reasons why the student’s results may not be reliable. (2 marks)

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- (ii)
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Question 3 continues opposite.

Question 3 (continued)

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(c) Design an experiment which would yield more reliable results. (6 marks)

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Section B – Criterion 4

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It is recommended that you spend approximately **30 minutes** on this section.

Question 4

The development of Tasmania’s Atlantic salmon industry has injected new life into the state's marketing and distribution of fish products.

- (a) In what ways does farmed salmon offer a more economically reliable option for aquaculture in Tasmania? (2 marks)

- (i)

- (ii)

- (b) Describe **two** reasons why Tasmania provides an ideal environment for the farming of salmon. (4 marks)

- (i)

- (ii)

Question 4 continues opposite.

Question 4 (continued)

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Some of the major companies farming salmon in Tasmania operate as vertically integrated companies. This means they are involved in all stages of salmon production from hatchery operations, through farming, processing, distribution and marketing.

(c) Discuss **two** economic advantages of ‘vertical integration’. (4 marks)

(i)

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(ii)

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Question 5

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NP Power Pty Ltd, part of the California-based National Power group, has applied for approval to develop Tasmania’s first privately owned wind farm at Cattle Hill, a grazing property north-west of Bothwell. The proposed 4,000 ha operation, the biggest project of its kind in the state, would be almost twice the size of Woolnorth.

(a) Describe **two** key impacts this project would have on the region. (4 marks)

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(ii)
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(b) Discuss how Tasmanian and mainland Australian householders would benefit economically and socially from the establishment of the proposed \$500 million wind farm. (4 marks)

(economically)
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(socially)
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Question 5 continues opposite.

Question 5 (continued)

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- (c) Outline your response to the statement '*better to save energy through its conservation than to find new ways of producing it*'. (4 marks)

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Question 6

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Ginseng is a popular herb grown for its exceptional healing properties, and is a significant part of the trade in herbal medicines in countries such as China and Korea. In 2001, world production was recorded at 69,873 tonnes with China and Korea producing 74% and 18% of the world market, respectively. Ginseng is currently identified as an alternative high-value commercial crop in Tasmania.

(a) In view of the age of the available data discuss **two** reasons why it is **very important** to undertake a current feasibility study that clearly identifies key research and development issues, production costs, and the availability of markets before investing in the commercial production of a new crop, such as ginseng, in Tasmania. (4 marks)

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(b) Describe how the development of a ginseng industry in Tasmania would benefit the state’s economy through other business opportunities. (2 marks)

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(c) Identify **two additional factors** which might need to be considered when trying to have Australian-grown ginseng accepted and sold in countries such as China and Korea. Explain the importance of **one** of these factors. (2 marks)

(i)
(ii)

Explanation
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Section C – Criterion 7

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You should spend approximately **30 minutes** on this question.

Question 7

You are a dairy farmer who has decided to diversify and commit a significant area of your farmland to the establishment of a wind farm for the generation, personal use and sale of surplus energy.

- (a) List **four** different aspects that need to be considered when developing a business plan for the establishment of a wind farm. (4 marks)

(i)

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(ii)

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- (b) Describe **two** different aspects of managing the wind farm to ensure the business is operating successfully. (4 marks)

(i)

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(ii)

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Question 7 continues over the page.

Question 7 (continued)

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(c) Managers are unable to control all the things that influence the sustainability of a business. List **three** factors that you as the manager cannot control and **explain** how they could affect the sustainability of your combined dairy/wind farm. (6 marks)

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(d) For **one** of the factors listed in (c) above, explain how you would **minimise** its risk to the sustainability of the business. (2 marks)

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Question 7 continues opposite.

Question 7 (continued)

- (e) Explain how your combined dairy/wind farm operation should be evaluated. (4 marks)

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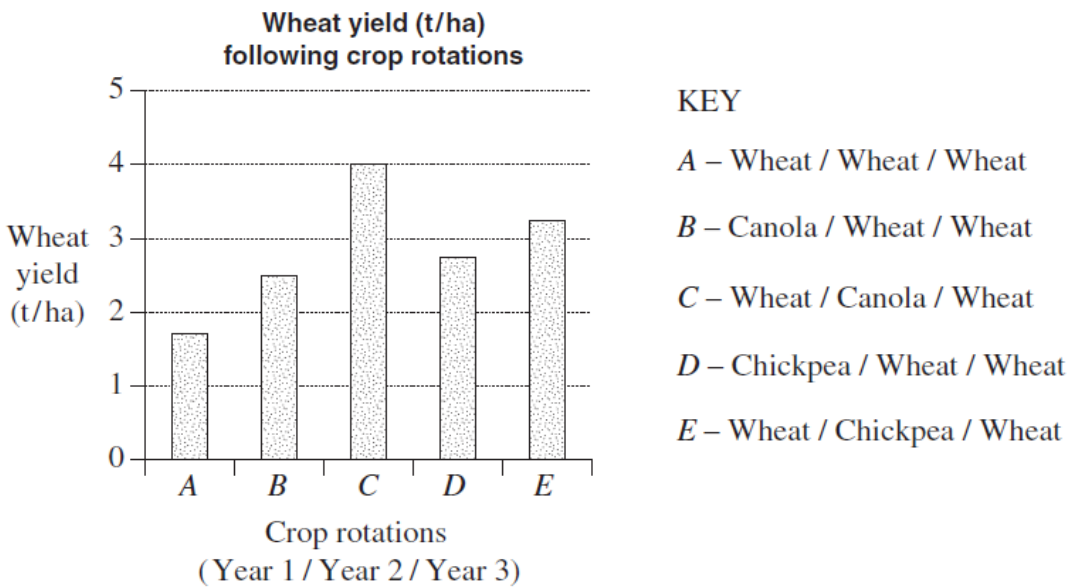
Section D – Criterion 8

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Question 9

The graph shows wheat yield in tonnes per hectare in the final year for a number of three-year crop rotation systems in Tasmania.



- (a) Which crop rotation resulted in the highest wheat yield in the final year? (1 mark)

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- (b) Describe **one** way that crop rotations can increase crop yields. (2 marks)

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Question 10

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Three tree species in a Tasmanian forest have different methods of surviving fire.

Species A produces seeds which are stored in the soil and will not germinate until the heat of a fire cracks the seed coat. All trees of this species are killed by fire.

Species B trees survive fire by resprouting profusely from the trunk. As well, seeds of this species germinate readily after fire.

Species C produces seeds every third year. These remain viable for six months and germinate after fire. The trees of this species are killed by fire.

Seeds of species A and B cannot germinate and establish under a closed forest canopy, but seeds of species C can.

- (a) What would be the result of fires in two successive years in a mixed forest containing these three species? (3 marks)

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- (b) What would be the long-term result of no fires at all in the forest? (3 marks)

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Question 10 continues opposite.

Question 10 (continued)

- (c) Which species would you consider best adapted to a dry environment? Explain your answer. (2 marks)

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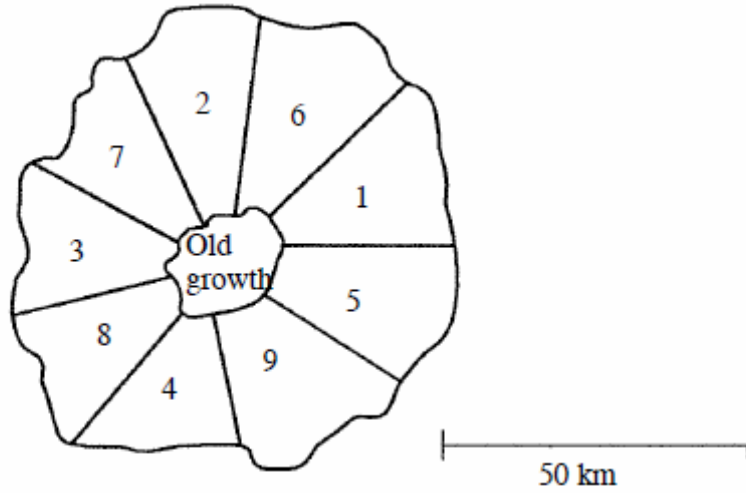
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Question 11

The diagram shows a method of sustainable logging of an area of natural wet sclerophyll forest. Each of sectors 1 to 9 is logged in sequence and the 'old growth' area is never felled. After 80 years all nine sectors have been logged.



Suggest how the pattern of logging shown in the diagram would help to maintain the harvesting of timber long-term. (4 marks)

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Question 12

Table 1 shows world energy usage in terawatts (TW = 10¹² watts) from 1965 to 2005, and gives projected world energy usage for 2025 and 2055.

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<i>Year</i>	<i>Oil (TW)</i>	<i>Coal (TW)</i>	<i>Gas (TW)</i>	<i>Other Energy sources (TW)</i>
1965	2.0	2.0	0.8	0.1
1975	3.5	2.2	1.5	0.2
1985	3.7	2.7	2.0	0.4
1995	4.3	3.0	2.5	0.6
2005	5.0	3.8	3.3	0.9
2025	4.0	3.8	3.8	2.1
2055	1.5	3.9	4.3	4.4

- (a) Using information in Table 1 above, predict **one** economic effect of projected world energy usage. (2 marks)

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Table 2 below gives details of some major mineral provinces in Australia.

<i>Resource in the Province</i>	<i>Current reserves Metric tonnes (Mt)</i>	<i>Current ore production (Mt per year)</i>
Iron	1400	100
Nickel	600	30
Silver, lead, zinc	15	2
Copper, gold	480	30
Titanium	400	4

- (b) Using information in Table 2 above: (2 marks)

- (i) which resource will last the longest **and** over how many years? Show all working.

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- (ii) which resource will last the least time **and** over how many years? Show all working.

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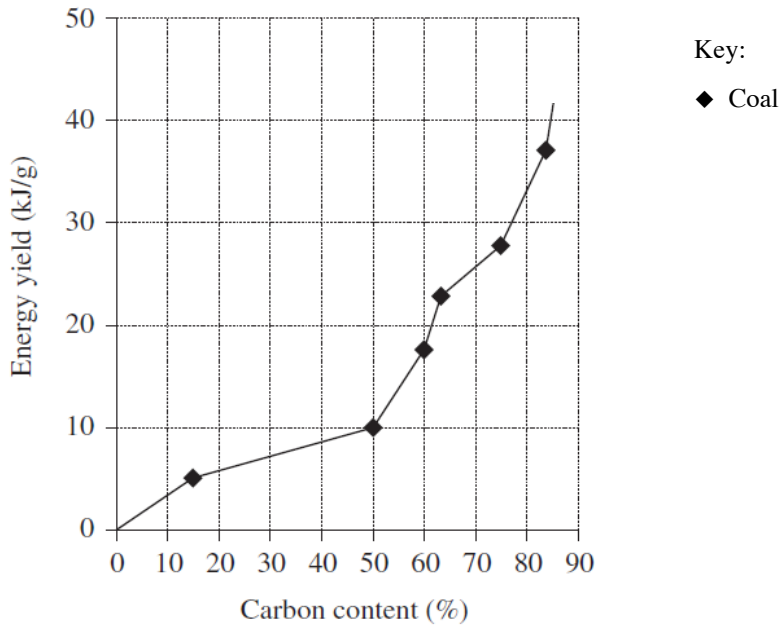
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Question 12 continues opposite.

Question 12 (continued)

The graph below shows the energy yield and carbon content for several grades of coal found in Tasmania.

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- (c) Describe the trend in energy yield of coal relative to carbon content. (2 marks)

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- (d) The average carbon content of petrol is 85 percent which yields about 43 kJ/g energy.

- (i) Describe **one** advantage that petrol has over coal as a fuel. (1 mark)

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- (ii) Describe **one** advantage that coal has over petrol as a fuel. (1 mark)

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Question 13

Mercury is a heavy metal and a poison which accumulates in the fatty tissues of organisms. Scientists have monitored the concentrations of mercury in Lake Pedder in Tasmania. They measured mercury concentrations in the water and in sediments at the bottom of the lake at each of five locations. The table below presents results from the measurements. Mercury concentrations are given as nanograms (10^{-9} g) per litre (ng/l).

Water released from Lake Pedder flows down the Gordon River into Macquarie Harbour.

<i>Sample number</i>	<i>Mercury concentrations in water (ng/l)</i>	<i>Mercury concentrations in sediment</i>
1	2.2	30.4
2	2.2	16.9
3	3.1	23.1
4	2.7	41.5
5	1.4	8.4

- (a) Calculate the average concentration of mercury in water and in sediment, and then determine the ratio of mercury concentration in the water to that in the sediment. Show all working. (3 marks)

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- (b) Why is it important to monitor the quality of water sourced from catchment areas with a history of mining? (1 mark)

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Question 13 continues opposite.

Question 13 (continued)

- (c) Describe the potential impact of water from Lake Pedder entering Macquarie Harbour. (3 marks)

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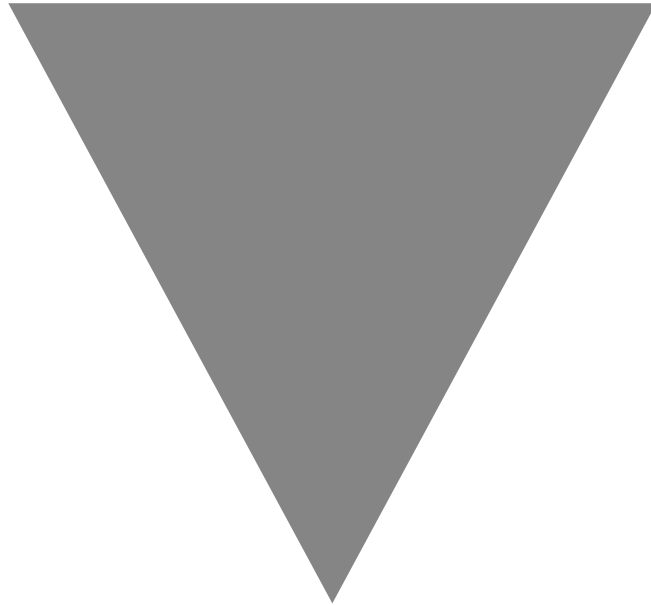
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