projectmaths

MATHEMATICS STANDARD 2

HSC Exam* Questions by Topic 2014 - 2018

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Year 11 Course

Algebra

A1: Formulae and equations

A2: Linear relationships

Measurement

M1.1: Practicalities of measuring

M1.2: Perimeter, area and volume

M1.3: Units of energy and mass

M2: Working with time

Financial Mathematics

F1.1: Interest and depreciation

F1.2: Earning & managing money

F1.3: Budgeting and household expenses

Statistics Analysis

S1.1: Classifying and representing data

S1.2: Summary Statistics

S2: Relative frequency & probability

Year 12 Course

Algebra

A4.1: Simultaneous Linear Equations

A4.2: Non-linear relationships

Measurement

M6: Non-right-angled trigonometry

M7: Rates and ratio

Financial Mathematics

F4.1: Investments

F4.2: Depreciation and loans

F5: Annuities

Statistics Analysis

S4: Bivariate data analysis

S5: The normal distribution

Networks

N2.1: Network concepts

N2.2: Shortest paths

N3: Critical path analysis

Mathematics Standard 2 Reference Sheet (2019 HSC)

*** Questions by Topic from …**

- **Mathematics Standard 2 HSC sample questions (2018)**
- **2014 – 2018 Mathematics General 2 HSC**
- **Mathematics General 2 Specimen HSC Paper (2014)**

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Year 11: Measurement: Applications of Measurement
M1.3 Units of energy and mass

Back

NOTE: Listed below are the dot points in the new Year 12 Mathematics Standard 2 syllabus which have not been examined in previous Mathematics General 2 or General Mathematics HSC exams:

- review the use of metric units of mass in solving problems, including grams, kilograms and tonnes, their abbreviations and how to convert between them.
- use metric units of energy to solve problems, including calories, kilocalories, joules and kilojoules, their abbreviations and how to convert between them.
- use units of energy and mass to solve problems related to food and nutrition, including calories.
- use units of energy to solve problems involving the amount of energy expended in activities, for example kilojoules.

S **5** *Sample question* **1** Solution

Walking speed	*Energy used in 30 minutes*
3 km/h	5.53 kJ/kg
5 km/h	7.37 kJ/kg

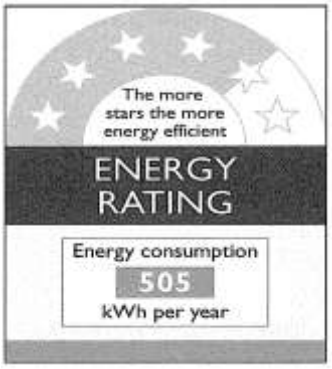
The table shows the average energy used, in kilojoules per kilogram of body mass, by a person walking for 30 minutes at different speeds.
Sam, who weighs 65 kg, drinks a regular cappuccino made with full cream milk. It contains 73 kilocalories.
For approximately how long must Sam walk at 3 km/h to burn off the energy contained in the cappuccino? (1 kilocalorie = 4.184 kJ.)
A. 20 minutes B. 25 minutes C. 90 minutes D. 120 minutes

18 **28 c** Every day, a 1200-watt microwave oven is used for 45 minutes at 40% power. Electricity is charged at $0.25 per kWh. What is the cost of running this microwave oven for 180 days? **3** Solution

17 **26 a** Electricity costs $0.27 per kWh. How much does 20 kWh cost? **1** Solution

16 **28 b** The cost of buying a new heater is $990. It uses energy according to the following energy label. Energy is charged at the rate of $0.35/kWh.

How much will it cost in total to purchase and then run this heater for five years? **2** Solution



14 **20** In a household of 4, each member uses an average of 13 minutes of hot water per day. The household uses a 9 kW hot water unit. Electricity is charged at 11.97 c/kWh when the hot water unit is being used. What is the electricity cost for the hot water used by this household in one week? **1** Solution
(A) $1.63 (B) $6.54 (C) $392.14 (D) $653.56

SP **15** A 2400 watt heater is run for 7 hours each day. If electricity is charged at 25.1 c/kWh, what is the cost of running the heater for 10 days, to the nearest cent? **1** Solution
(A) $4.22 (B) $42.17 (C) $421.68 (D) $4216.80

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Year 12: MS – M: Measurement

M6: Non-right-angled trigonometry

Back

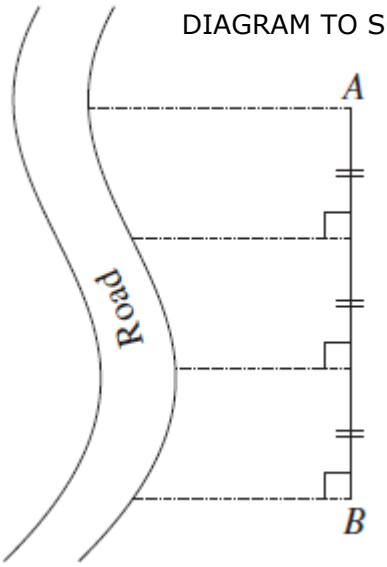
NOTE: Listed below are the dot points in the new Year 12 Mathematics Standard 2 syllabus which have not been examined in previous Mathematics General 2 or General Mathematics HSC exams:

- None

S 16 *Sample question* **3** Solution

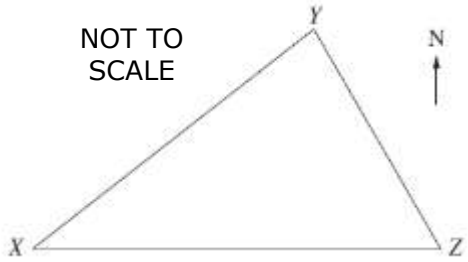
The scale diagram shows the aerial view of a block of land bounded on one side by a road. The length of the block, *AB*, is known to be 45 metres.
Calculate the approximate area of the block of land, using three applications of the trapezoidal rule.

[A note to students from *projectmaths*: Use a ruler to measure *AB* as 4.5 cm]



S 18 *Sample question* Solution

The diagram shows the three towns *X*, *Y* and *Z*. Town *Z* is due east of Town *X*. The bearing of Town *Y* from Town *X* is N39°E and the bearing of Town *Z* from Town *Y* is S51°E.
The distance between Town *X* and Town *Y* is 1330 km.
A plane flies between the three towns.



(a) Mark the given information on the diagram and explain why $\angle XYZ$ is 90°. **2**

(b) Find the distance between Town *X* and Town *Z* to the nearest kilometre. **2**

(c) The plane is going to fly from Town *Y* to Town *X*, stopping at Town *Z* on the way. Leaving Town *Y*, the pilot incorrectly sets the bearing of Town *Z* to S50°E. The pilot flies for 1650 km before realizing the mistake, then changes course and flies directly to Town *X* without going to Town *Z*. Which is closer to Town *X*: Town *Z* or the point where the pilot changes course? Justify your answer. **3**

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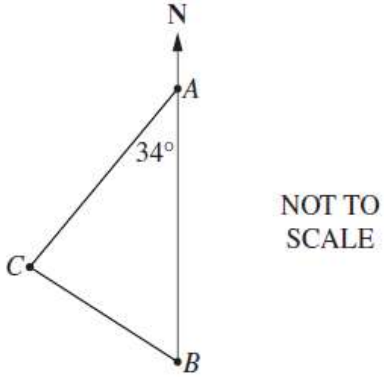
18 7 The diagram shows the positions of towns *A*, *B* and *C*. Town *A* is due north of town *B* and $\angle CAB$ 34°.
What is the bearing of town *C* from town *A*?
A. 034°
B. 146°
C. 214°
D. 326° **1** Solution



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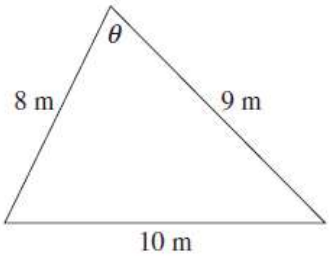
18 **12** The diagram shows a triangle with side lengths 8 m, 9 m and 10 m. What is the value of θ, marked on the diagram, to the nearest degree?

A. 49°
B. 51°
C. 59°
D. 72°



NOT TO SCALE

1 Solution

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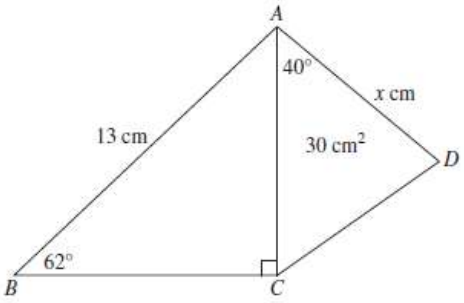
18 **30** **c** The diagram shows two triangles. Triangle ABC is right-angled, with $AB = 13$ cm and $\angle ABC = 62°$. In triangle ACD, $AD = x$ cm and $\angle DAC = 40°$. The area of triangle ACD is 30 cm^2. What is the value of x, correct to one decimal place?



NOT TO SCALE

3 Solution

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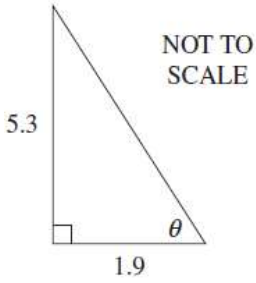
17 **8** The diagram shows a right-angled triangle. What is the value of θ, to the nearest minute?

(A) 70° 16′
(B) 70° 17′
(C) 70° 27′
(D) 70° 28′



NOT TO SCALE

1 Solution

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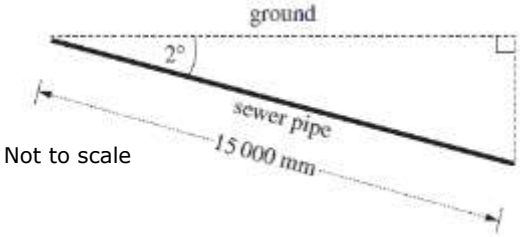
17 **26** **d** A sewer pipe needs to be placed into the ground so that it has a 2° angle of depression. The length of the pipe is 15 000 mm. How much deeper should one end of the pipe be compared to the other end? Answer to the nearest mm.



Not to scale

2 Solution

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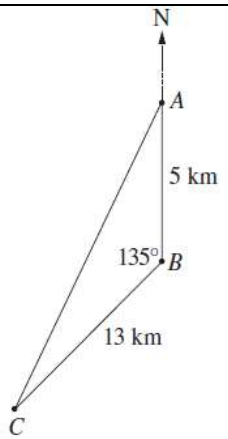
17 **30** **c** The diagram shows the location of three schools. School A is 5 km due north of school B, school C is 13 km from school B and $\angle ABC$ is 135°.

(i) Calculate the shortest distance from school A to school C, to the nearest kilometre. **2**

(ii) Determine the bearing of school C from school A, to the nearest degree. **3**

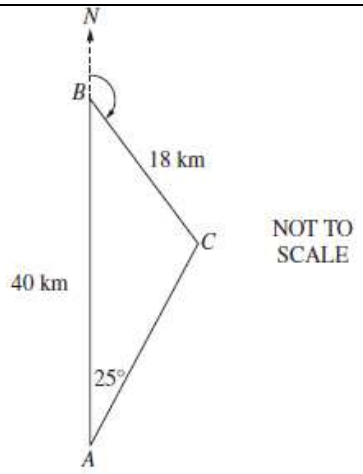


NOT TO SCALE

Solution

16 **25** The diagram shows towns *A*, *B* and *C*. Town *B* is 40 km due north of town *A*. The distance from *B* to *C* is 18 km and the bearing of *C* from *A* is 025°. It is known that $\angle BCA$ is obtuse. What is the bearing of *C* from *B*?

(A) 070°
(B) 095°
(C) 110°
(D) 135°



1 Solution

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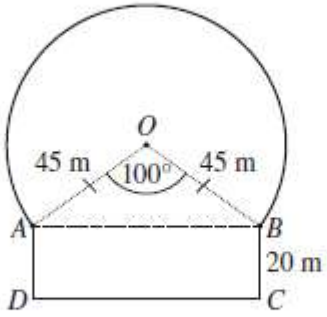
16 **30 c** A school playground consists of part of a circle, with centre *O*, and a rectangle as shown in the diagram. The radius *OB* of the circle is 45 m, the width *BC* of the rectangle is 20 m and $\angle AOB$ is 100°.

What is the area of the whole playground, correct to the nearest square metre?



5 Solution

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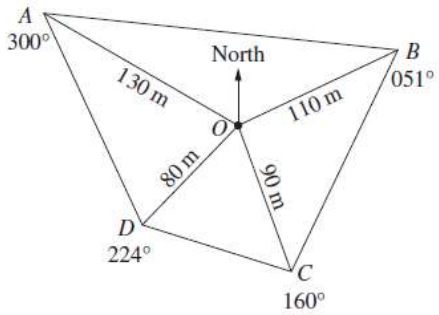
15 **7** The diagram shows a radial survey of a field *ABCD*.

In triangle *AOB*, what is the size of $\angle AOB$?

(A) 51°
(B) 111°
(C) 125°
(D) 249°



NOT TO SCALE

1 Solution

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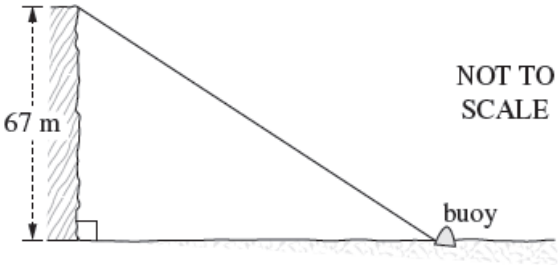
15 **9** From the top of a cliff 67 metres above sea level, the angle of depression of a buoy is 42°. How far is the buoy from the base of the cliff, to the nearest metre?

(A) 60 m
(B) 74 m
(C) 90 m
(D) 100 m



1 Solution

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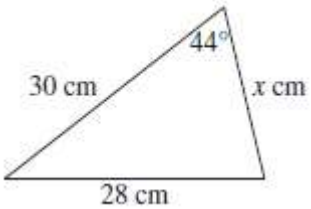
15 **22** The area of the triangle shown is 250 cm^2. What is the value of *x*, correct to the nearest whole number?

(A) 11
(B) 18
(C) 22
(D) 24



NOT TO SCALE

1 Solution

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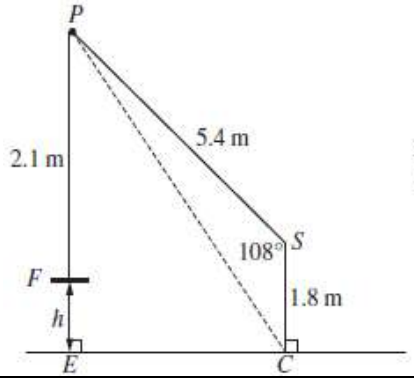
15 **30** **e** From point *S*, which is 1.8 m above the ground, a pulley at *P* is used to lift a flat object *F*. The length *SP* and *PF* are 5.4 m and 2.1 m respectively. The angle *PSC* is 108°.

(i) Show that the length *PC* is 6.197 m, correct to 3 decimal places. **1**

(ii) Calculate *h*, the height of the object above the ground. **4**

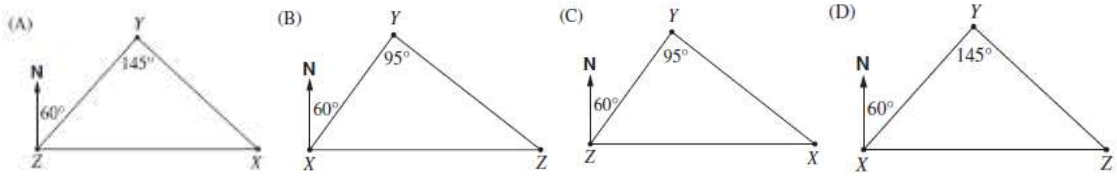


Solution

14 **23** The following information is given about the locations of three towns *X*, *Y* and *Z*: **1**

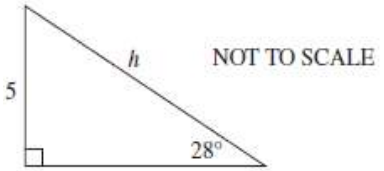
- *X* is due east of *Z*
- *X* is on a bearing of 145° from *Y*
- *Y* is on a bearing of 060° from *Z*

Which diagram best represents this information? (Diagrams not to scale)



Solution

14 **26** **b** Calculate the value of *h* correct to two decimal places. **2**



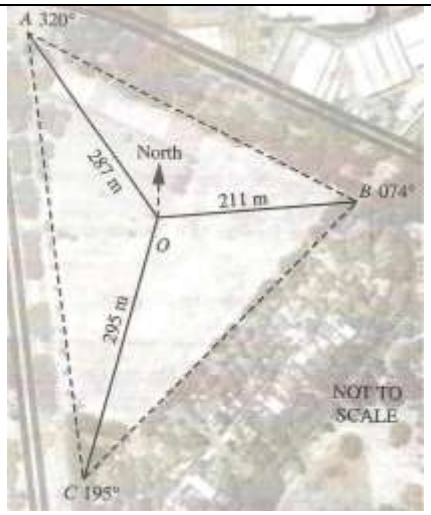
Solution

14 **28** **b** A radial compass survey of a sports centre is shown in the diagram.

(i) Show that the size of the angle *AOB* is 114°. **1**

(ii) Calculate the length of the boundary *AB*, to the nearest metre. **2**

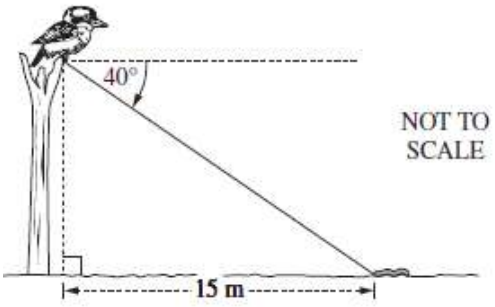
(iii) Find the area of triangle *AOB* in hectares, correct to two significant figures. **3**



Solution

SP **3** **11** **4** The angle of depression from a kookaburra's feet to a worm on the ground is 40°. The worm is 15 metres from a point on the ground directly below the kookaburra's feet. How high above the ground are the kookaburra's feet, correct to the nearest metre?

(A) 10 m (B) 11 m
(C) 13 m (D) 18 m

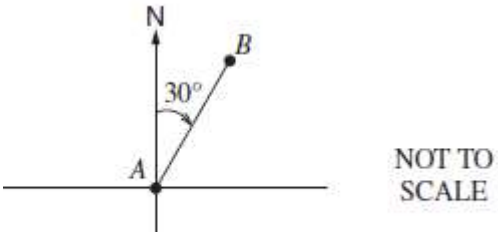


1 Solution

SP **10** A plane flies on a bearing of 030° from *A* to *B*, as shown in the diagram.

What is the bearing of *A* from *B*?

(A) 030° (B) 150°
(C) 210° (D) 330°



1 Solution

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Year 12: MS – N: Networks

N3: Critical path analysis

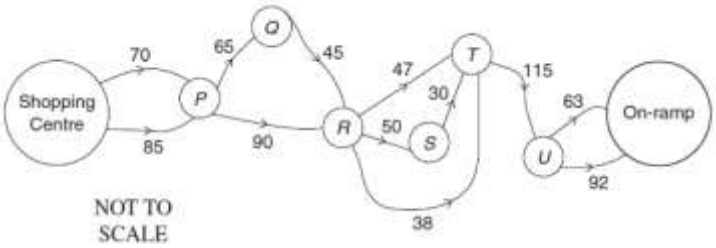
Back

NOTE: Listed below are the dot points in the new Year 12 Mathematics Standard 2 syllabus which have not been examined in previous Mathematics General 2 or General Mathematics HSC exams:

Students:

- construct a network to represent the duration and interdependencies of activities that must be completed during a particular project, for example a student schedule, or preparing a meal **AAM**
- given activity charts, prepare network diagrams and use critical path analysis to determine the minimum time for a project to be completed **AAM**
  - use forward and backward scanning to determine the earliest starting time (EST) and latest starting time (LST) for each activity in the project (ACMGM105)
  - understand why the EST for an activity could be zero, and in what circumstances it would be greater than zero
  - calculate float times of non-critical activities (ACMGM108)
  - understand what is meant by critical path
  - use ESTs and LSTs to locate the critical path(s) for the project (ACMGM106)
- solve small-scale network flow problems, including the use of the 'maximum-flow minimum-cut' theorem, for example determining the maximum volume of oil that can flow through a network of pipes from an oil storage tank (the source) to a terminal (the sink) (ACMGM109) **AAM**
  - convert information presented in a table into a network diagram
  - determine the flow capacity of a network and whether the flow is sufficient to meet the demand in various contexts

S 17 *Sample question* **3** Solution



The network diagram represents a system of roads connecting a shopping centre to the on-ramp of a freeway. Traffic moves via several routes. For example, there are two routes from the shopping centre to *P* and one route from *T* to *U*. The number on the edge of each road indicates the number of vehicles that can travel on it per hour. At present, the capacity of the network from the shopping centre to the on-ramp is not maximised. It is not possible to construct a road directly between the shopping centre and the on-ramp. Suggest ONE way the network capacity can be maximized with additional road(s).

S 21 *Sample question* A project requires activities *A* to *G* to be completed, as shown in the table. The minimum completion time for the project is 50 days and the critical path includes activities *B*, *D*, *E* and *F*. The float for *G* is three days and the float for *C* is 8 days. Find a possible duration for each of the activities *A*, *C*, *F* and *G*. Include a network diagram in your answer. **5** Solution

Activity	*Immediate prerequisite(s)*	*Duration in days*
A	–	?
B	–	15
C	*A*	?
D	*A*, *B*	20
E	*D*	8
F	*C*, *E*	?
G	*D*	?

NSW Education Standards Authority

2019 HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 1
Mathematics Standard 2

REFERENCE SHEET

Measurement

Limits of accuracy

Absolute error $= \frac{1}{2} \times$ precision

Upper bound = measurement + absolute error

Lower bound = measurement − absolute error

Length

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a + b)$$

$$A \approx \frac{h}{2}(d_f + d_l)$$

Surface area

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

$$A = \frac{1}{2}ab\sin C$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Financial Mathematics

$$FV = PV(1 + r)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

$$S = V_0(1 - r)^n$$

Statistical Analysis

An outlier is a score

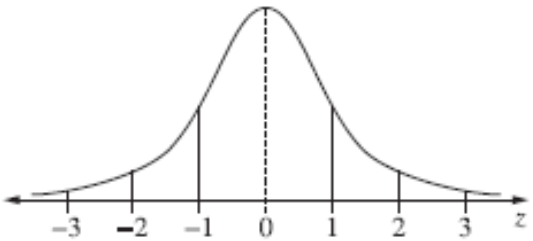
less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

$$z = \frac{x - \bar{x}}{s}$$

Normal distribution



- approximately 68% of scores have z-scores between −1 and 1
- approximately 95% of scores have z-scores between −2 and 2
- approximately 99.7% of scores have z-scores between −3 and 3