University of South Australia

If you are required to use a calculator, please note the make and model here:

Calculator Make:

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2006 Mid Year Examination

Student ID Number	**Student ID Number**									

Family Name	
Given Names	

Division of Information Technology, Engineering and the Environment

School of Natural and Built Environments

Course Name: Geodetic Concepts

Subject Area **GEOE** **Catalogue Number** **2009**

Examination Day **Tuesday** **Examination Date** **27/06/2006**

Examination Time **14:00** **Length of Exam** **3 hours**

Examination Venue:	**RAS/Ridley Centre**

Instructions to Candidates

This examination is open book.

All questions are of equal value. Marks for parts of questions are as indicated.

Answer any **FIVE** questions from a total of **SEVEN**.

Please ensure the front of your answer books are completed with your name, student I.D. number, course and section of the examination.

University of South Australia

2006 Mid Year Examination

QUESTION 1 [20 marks]

a) What is the spherical excess in a spherical triangle and what is the mathematical relationship between spherical excess and the area of the spherical triangle? Show all units.

(5 marks)

b) Summarize the historical scientific and observational evidence which substantiates that the shape of the earth is an oblate spheroid. Why is it important to know the shape of the earth?

(10 marks)

c) Define the following terms as they apply to map projections:

(i) Conformality
(ii) Equidistance
(iii) Equivalence

(5 marks)

QUESTION 2 [20 marks]

a) The solution of a spherical triangle depends upon a set of formulae which are governed by the "sine" and "cosine" rules from which all other formulae can also be derived. Outline the formulae for the "sine" and "cosine' rules as applied to a spherical triangle and discuss any limitations you may confront when using them and how these limitations may be overcome.

(5 marks)

b) Explain, with the aid of a diagram, the difference between geodetic, geocentric and reduced latitude.

(10 marks)

c) What is a false origin? In practice, why are they always placed outside the map zone being used?

(5 marks)

QUESTION 3 [20 marks]

a) When solving a spherical triangle, why is it important to draw a diagram and take careful note of the hemisphere indicators (i.e. ^{0}N, ^{0}S, ^{0}E, ^{0}W)?

(5 marks)

b) Is the distance along a normal section between two points on the spheroid/ellipsoid greater than the corresponding distance along the geodesic? Is the difference significant at the centimetre level for a line 1500km in length?

(5 marks)

c) Explain what is a "grid bearing" and "plane bearing" between two points on a Universal Transverse Mercator projection.

(5 marks)

d) Why can a geocentric datum be used anywhere in the world for accurate mapping?

(5 marks)

QUESTION 4 [20 marks]

a) Explain, with the aid of diagrams, the difference between

(i) "latitude" and "co-latitude" and
(ii) "angle" and "azimuth"

(5 marks)

b) On the Australian Geodetic Datum 1966 (AGD66), the distances between successive "seconds" of latitude on the meridian are shown as 30.715 metres at the equator and 31.026 metres at the poles. Explain why these distances along the meridian are not the same.

(5 marks)

c) On any given map projection, where is the map the most accurate? Why?

(5 marks)

d) What parameters are required to define a geodetic datum?

(5 marks)

QUESTION 5 [20 marks]

a) The Stereographic, Universal Transverse Mercator and Lambert Conical Conformal projections are all examples of conformal projections. Discuss the differences between the three projections, including the projection surfaces, points/lines of contact and corresponding distortion patterns. Also discuss appropriate applications for each projection.

(20 marks)

QUESTION 6 [20 marks]

a) What is the rationale behind using a 2^0 zone width for a Universal Transverse Mercator (UTM) projection in local and provincial jurisdictions (e.g. New South Wales)?

(5 marks)

b) Three coordinate systems can be used to describe the position of objects and features on the earth's surface. With the aid of diagrams, describe these coordinate systems and discuss their advantages and disadvantages.

(15 marks)

QUESTION 7 [20 marks]

a) What types of distortion may be produced when geographic positions are projected onto two-dimensional maps? Which of these distortions are present in a UTM projection?

(10 marks)

b) Why is it important to know the values for the geoid-spheroid separation at different points on the earth's surface when establishing or comparing heights at these points?

(5 marks)

Questions 7(c) to (g) are multiple choice:

c) The three sides of a spherical triangle are:

(i) the arcs of great circles
(ii) the arcs of great and small circles
(iii) the arcs of small circles
(iv) none of the above

(1 mark)

d) For any given spheroid (ellipsoid):

(i) a parallel of latitude is an ellipse
(ii) a meridian of longitude is a circle
(iii) parallels of latitude and meridians of longitude are circles
(iv) a meridian of longitude is an ellipse
(v) none of the above

(1 mark)

e) The mean radius of curvature ($\bar{R}$) on a spheroid/ellipsoid at the North and South poles is equal to:

(i) a/b
(ii) b^2/a
(iii) a/b^2
(iv) a^2/b
(v) none of the above

where a is the semi-major axis and b is the semi-minor axis of the ellipsoid.

(1 mark)

f) Which of the following UTM projection conventions is incorrect?

(i) The grid distance is the length measured along the arc of a projected spheroidal distance
(ii) The line scale factor is a function of the northings of the endpoints of a projected spheroidal distance
(iii) Grid northings are projected great circles
(iv) Grid eastings are projected small circles
(v) None of the above

(1 mark)

g) The latitude, longitude and height displayed by a GPS receiver are the 3D coordinates of the antenna with respect to:

(i) The geocentric reference spheroid adopted for the GPS system
(ii) GDA 94
(iii) AUSGEOID98
(iv) AGD66
(v) None of the above

(1 mark)