

PRACTICE EXAM ON NEW SECTIONS OF STUDY DESIGN

Lesson : October 4

**DO NOT
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MARGIN**

Question 1

A flight from Rome (41.9°N, 12.5°E) to Dubai (25.0°N, 55.3°E) was scheduled to depart at 2:10 pm on Tuesday.

- a. i. What is the time difference between Rome and Dubai? Give your answer to the nearest hour.

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1 mark

- ii. What time is it in Dubai when it is 2: 10 pm on Tuesday in Rome?

1 mark

- (b) The flight departed Rome on time and arrived in Dubai at 12:15 am on Wednesday, Dubai time. How long was the flight?

1 mark

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Question 2

A light aircraft is scheduled to fly directly from Wagga Wagga to Sydney. Due to bad weather, the aircraft must fly another route.

- (a) The first leg of the journey has the aircraft travelling **due north** from Wagga Wagga $35^{\circ}\text{S}, 147^{\circ}\text{E}$ to Point A $33^{\circ}\text{S}, 147^{\circ}\text{E}$.

Determine the distance from Wagga Wagga to Point A, to the nearest km.

(Take the radius of the earth to be 6,400 km)

- (b) The second leg of the journey has the aircraft travelling **due east** from Point A $(33^{\circ}\text{S}, 147^{\circ}\text{E})$ to Sydney $(33^{\circ}\text{S}, 152^{\circ}\text{E})$.

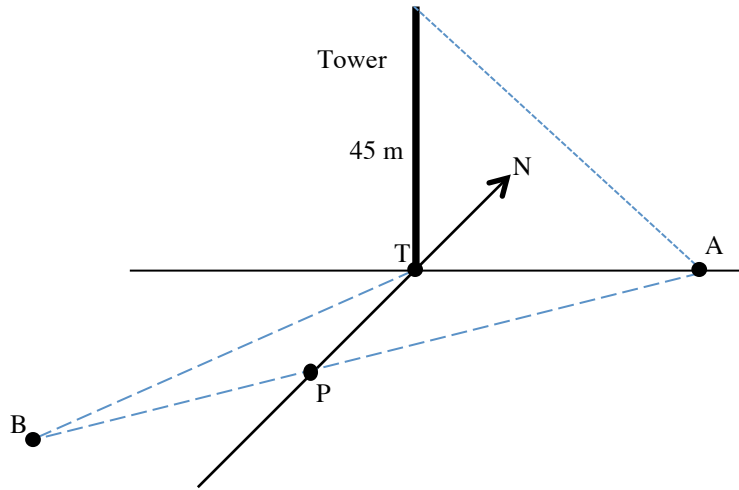
i. Calculate the radius of the circle of latitude where Sydney is located. Give your answer to the nearest km.

ii. Calculate the distance between Point A and Sydney flying **due east**. Give your answer to the nearest km.

2 marks

Question 3

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The diagram above shows a flat section of land with a 45 m high tower. Point A is directly east of the tower.

- (a) The angle of elevation from Point A to the top of the tower is 40° .

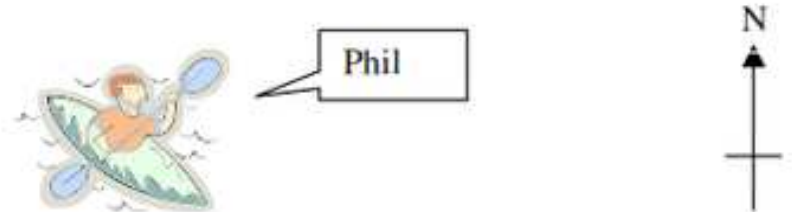
Determine the horizontal distance from Point A to the base of the tower (T).

Give your answer correct to four significant figures.

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- (b) Point B is 30 m directly south of the tower. Point P is in a direct line of sight from Point A when viewed from point B. Determine the bearing of Point A **from** Point B. Give your answer to the nearest degree.

Two canoeists at sea are aiming for the same point (a buoy). Phil is 1 500 m from the buoy at a bearing of 160°T . Phil also sees Kim, another canoeist, 2 200 m away at a bearing of 221°T from him.



- (a) Determine the distance Kim is from the buoy. Give your answer in metres correct to four significant figures.

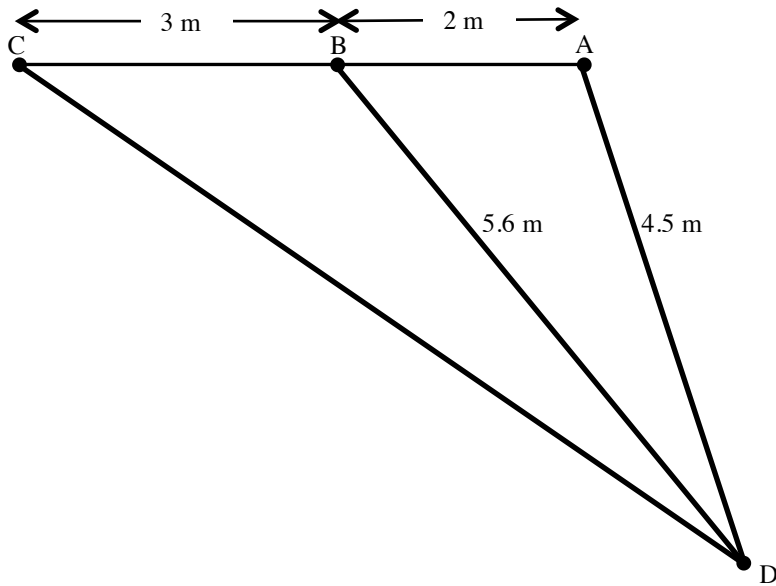
2 marks

- (b) Determine the bearing that Kim will have to travel on to reach the buoy. Give your answer to the nearest degree.

2 marks

Question 4

The diagram of a steel construction is shown below.



**For
Marker
Use
Only**

Determine the length of the beam CD. Give your answer in metres correct to three significant figures.

t C B A

2 marks

Question 5

In order to buy a second-hand scooter, Kim obtained a personal loan of \$5000 with monthly repayments of \$440 to be paid at the end of each month. The table below shows the amount owing at the start of each month, the interest payable for that month, the repayment and the amount owing at the end of each month for the first six months.

Month	Amount owing at the start of the month (\$)	Interest (\$)	Repayment (\$)	Amount owing at the end of the month (\$)
1	5000	40	440	4600
2	4600	36.80	440	4196.80
3	4196.80	33.57	440	3790.37
4	3790.37	30.32	440	3380.70
5	3380.70	27.05	440	2967.74
6	2967.74	23.74	440	2551.48

- (a) Calculate the annual interest rate. (2 marks)
- (b) Write a recursive rule to determine the amount owing at the end of each month. (2 marks)
- (c) In which month would Kim pay off the loan? (1 mark)
- (d) How much is Kim's final repayment? Give your answer to the nearest cent. (2 marks)
- (e) How much did Kim actually pay for the scooter? Give your answer to the nearest cent. (2 marks)

Question 6

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A ship leaves from the harbour of Christchurch, New Zealand ($44^{\circ}\text{S } 173^{\circ}\text{E}$) and sails **due east** to the entrance of the harbour of Castro, Chile ($44^{\circ}\text{S } 74^{\circ}\text{W}$).

- (a) Calculate the distance covered in this journey, to the nearest kilometre.
Assume that the radius of the Earth is 6371 km. **Working must be shown.**

3 marks

- (b) The ship left Christchurch at 8:30 am Monday Christchurch time.

- i. What is the time difference between Christchurch and Castro, to the nearest hour?

1 mark

- ii. The ship left Christchurch 8:30 am on Monday. What time was it in Castro when the ship left Christchurch?

1 mark

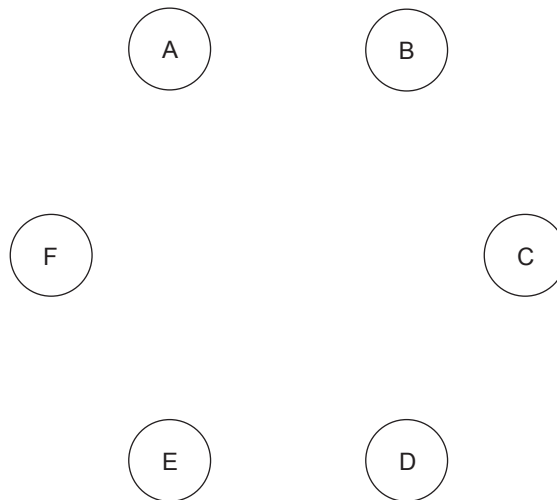
Question 8

Six friends — Anna (A), Betty (B), Chris (C), Dennis (D), Enzo (E), and Fred (F) — decided to spend the weekend playing a 'round robin' lawn bowls tournament in which each of the friends would play a match against each of the others.

By lunchtime on Sunday:

- Anna had defeated Enzo and Fred
- Betty had defeated Anna, Chris, and Fred
- Chris had won against Anna, Dennis, Fred and Enzo
- Dennis had won against Betty and Anna
- Enzo had defeated Dennis, Fred, and Betty
- Fred had defeated Dennis.

- (a) Using the nodes in the diagram below, draw a network diagram to show this information.



(2 marks)

- (b) Complete the dominance matrix D below

$$D = \begin{matrix} & \begin{matrix} A & B & C & D & E & F \end{matrix} \\ \begin{matrix} A \\ B \\ C \\ D \\ E \\ F \end{matrix} & \begin{bmatrix} 0 & 0 & 0 & 0 & \text{---} & 1 \\ 1 & 0 & 1 & 0 & \text{---} & 1 \\ 1 & 0 & 0 & 1 & \text{---} & 1 \\ \text{---} & \text{---} & \text{---} & \text{---} & \text{---} & \text{---} \\ 0 & 1 & 0 & 1 & \text{---} & 1 \\ 0 & 0 & 0 & 1 & \text{---} & 0 \end{bmatrix} \end{matrix}$$

(2 marks)

- (c) (i) Calculate $T = D + D^2$ to rank the players from first to last on the matches played so far.
List the players from first to last.

2 marks

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Question 9

A car is initially purchased for \$24 000 and depreciates by \$1700 per year.

- a. Write a recursive relation that gives the value of the car in dollars after $n + 1$ years, in terms of its value after n years. Write both parts of the rule, including for V_0 , on the same line, separated by a comma.

- b. Write down a rule that will give the value of the car after n years.

- c. During which year will the value of the car fall below \$10 100?

(1 + 1 + 1 = 3 marks)

Question 10

Tim is starting up his own business. He has saved \$15 000 to buy equipment and he borrows another \$50 000 from the bank. He is charged interest at the rate of 4.5% per annum, compounding monthly, and makes regular monthly repayments of \$400.

- a. Write down a calculation from which the amount that Tim owes at the end of the first month can be evaluated.

- b. Write a recurrence relation that gives the balance B_{n+1} in terms of the balance in the preceding month B_n .

- c. To the nearest month, how many months does it take for him to pay off his loan?

d. What is the value of Tim's final repayment? Give your answer to the nearest cent.

e. How much in total does Tim pay for his equipment? Give your answer to the nearest cent.

(1 + 1 + 1 + 1 + 1 = 5 marks)

Question 11

A new car depreciates in value each year according to the recursion relation:

$$V_{n+1} = 0.89V_n, V_0 = 21\,000$$

a. How much was the car purchased for?

1 mark

b. As a percentage, what was the annual depreciation rate?

1 mark

c. Determine the value of the car after 9 years. Give your answer to the nearest dollar.

2 marks

d. When the value of the car reaches \$600 it is considered useful only for parts. At the end of which year will it be considered useful only for parts?

2 marks

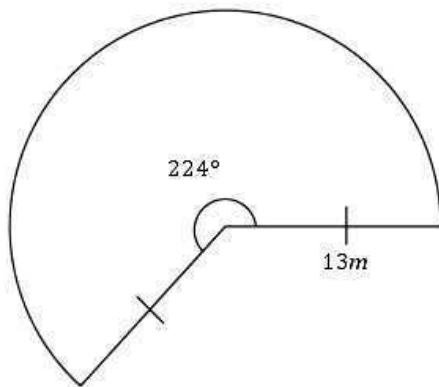
Question 13

A location has co-ordinates ($41^{\circ}S, 85^{\circ}W$). Find its distance from the equator, assuming that the earth's radius is 6 400 km. Give your answer to the nearest kilometre.

2 marks

Question 14

Calculate the area of the sector shown in the diagram below, in square metres, correct to one decimal place.



2 marks

Question 15

Mercury has a radius of 2 878 km.

- i. Calculate the radius of the small circle on Mercury that lies at a latitude of $28^{\circ}N$.
Give your answer correct to three significant figures.

- ii. Calculate the total distance around this small circle, correct to the nearest km.

(2 + 2 = 4 marks)