MODULE 16
SKIM TUISYEN FELDA (STF) MATEMATIK SPM "ENRICHMENT"
TOPIC : EARTH AS A SPHERE
TIME : 2 HOURS

1. (50ºS, 70ºE), G, H and K are four points on the earth's surface. F, G and H are on the same latitude such that FG is the diameter. The longitude of H is 45ºW.

   (a) Find the longitude of G.

   (b) An aeroplane flew due west from F to H. It then flew 4800 nautical miles due north to K. Given that its average speed for the whole journey was 680 knots, calculate

      (i) the latitude of K,

      (ii) the distance, in nautical miles, from F to H,

      (iii) the time taken to complete the journey.

Answer:

(a)

(b) (i)

(ii)

(iii)

2. G (60ºS, 20ºW) and H are two points on the surface of the earth where GH is a diameter of the common parallel of latitude.

   (a) Find the latitude of H.

   (b) Given GL is a diameter of the earth. On the diagram in the answer space, mark the locations of H and L. Hence, state the location of L.

   (c) Calculate the shortest distance, in nautical miles, from H to the South Pole.

   (d) An aeroplane took off from G and flew due east along the common parallel of latitude at an average speed of 450 knots. The aeroplane took 8 hours to reach a point P. Calculate

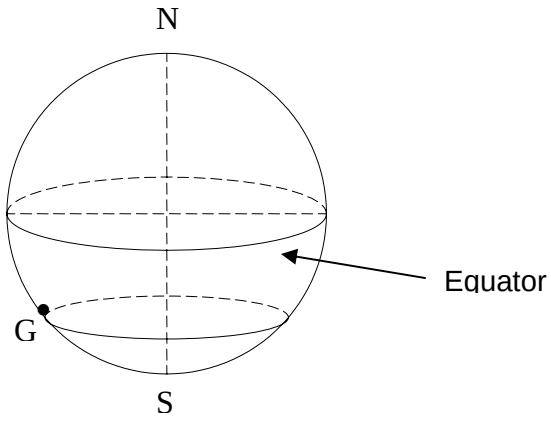
      (i) the distance, in nautical miles, from G to P,

      (ii) the longitude of P.

Answer:

(a)

(b)



(c)

(d)

3. P (51ºN, 20ºW) and Q are two points on the Earth's surface. PQ is a diameter of the latitude.

   (a) Find the longitude Q.

   (b) Given that PR is the Earth's diameter, mark the positions of Q and R on the diagram provided below. Hence, state the position of R.

   (c) Calculate the shortest distance, in nautical miles, from Q to the North Pole.

   (d) An aeroplane flew due west from P along the latitude with an average speed of 500 knots.The aeroplane took 9 hours to reach a point M. Calculate

      (i) the distance, in nautical miles, from P to M,

      (ii) the longitude of M.

Answer:

(a)

(b)

(c)

(d) (i)

(ii)

4. R (40ºN, 80ºW) , S and T are three points on the surface of the earth. RS is the diameter of a parallel of latitude 40ºN. T is 6600 nautical miles to the south of R.

   (a) State the longitude of S.

   (b) Find the latitude of T.

   (c) Calculate the shortest distance, in nautical miles, from R to S measured along the surface of the earth.

   (d) A ship sailed from S to R along the common parallel of latitude and then due south to T. The total time taken for the journey was 20 hours. Calculate the average speed of the ship for the whole journey.

Answer:

(a)

(b)

(c)

(d)

5. G (65ºN, 10ºW) and H (65ºN, θºE) are two points on the surface of the earth. GH is a diameter of the parallel of latitude 65ºN. A yacht sailed with an average speed of 375 knots from G to H using the shortest distance, as measured along the surface of the earth.

   (a) State the value of θ.

   (b) Mark the positions of points G and H on the diagram.

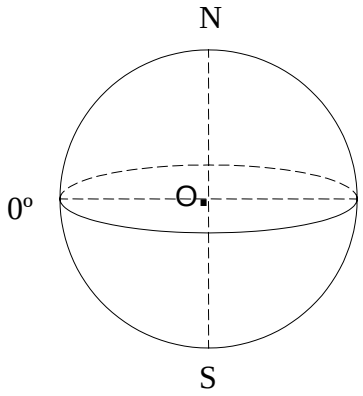
   (c) Calculate the shortest distance, in nautical miles, from point G to point H.

   (d) Calculate the total time, in hours, taken for the yacht to sail from point G to point H.

Answer:

(a)

(b)



(c)

(d)

6. P (50ºs,40ºw), Q (50ºS, 90ºE), R and T are four points on the earth's surface. PR is the diameter of the common latitude.

   (a) (i) State the longitude of R.

   (ii) Calculate the ratio of the distance from P to R through the South Pole to its distance through North Pole.

   (iii) Calculate the distance, in nautical miles, from P to Q due east as measured along the common latitude.

   (b) Find the latitude of T which is situated 3900 nautical miles due North of Q.

Answer:

(a) (i)

(ii)

(iii)

(b)

MODULE 16 - ANSWERS
TOPIC: EARTH AS A SPHERE

1. (a) 110 °W 2m

(b)(i) $\angle$ HOK = $\frac{4800}{60}$ 1m

= 80° 1m

Latitude of K = 80 – 50
= 30°N 1m

(ii) Distance F to H
= (70 + 45) 60 cos 50° 2m
= 4435.23 n.m 1m

(iii) Time = $\frac{4435.23 + 4800}{680}$ 3m
= 13.58 hrs 1m

2. (a) 60°S 2m

(b) Point H 1m
Point L 1m
L (60°N, 160°E) 1m

(c) Distance H to south pole
= 30 X 60 1m
= 1800 n.m. 1m

(d) (i) Distance = 450 x 8 1m
= 3600 n.m. 1m

(ii) $\angle$ GOP = $\frac{3600}{60\cos 60°}$ 2m
= 120°

Longitude = 120° - 20° = 100°E 1m

3. (a) Longitude of R = 95°E 2m

(b) Distance PR = 40 x 60 1m
= 2400 n.m. 1m

(c) Distance PQ = (85 – 30) 60 cos 70° 3m
= 1128.67 n.m. 1m

(d) Time = $\frac{160 \times 60}{600}$ 3m
= 16 hrs 1m

4. (a) Longitude of S = 100° E 2m

(b) $\angle$ ROT = $\frac{3600}{60}$ 1m
= 60° 1m

Latitude of T = 60 – 40 1m
= 20°S 1m

(c) Distance R to S
= 100 x 60 1m
= 6000 n.m. 1m

(e) Average speed = $\frac{180 \times 60 \times \cos 40 + 3600}{20}$ 3m

= $\frac{8273.30 + 3600}{20}$

= 593.66 n.m. 1m

5. (a) θ =170°E 2m

(b) Point G 2m
Point H 2m

(c) Distance G to H
= 50 x 60 2m
= 3000 n.m 1m

(d) Time = $\frac{3000}{375}$ 2m
= 8 hrs 1m

6. (a) (i) Longitude of R = 140°E 2m

(ii) Distance PR via S : Distance PR via N
80x 60 : 280 x 60 2m
2 : 7 1m

(iii) Distance P to Q
= (40 + 90) 60 x cos 50° 3m
= 5013.74 n.m 1m

(b) $\angle$ QOT = $\frac{3900}{60}$ 1m

= 65° 1m

Latitude of T = 65º – 50º
= 15°N 1m