Mth 112 Circles Galore and a few More *Franz Helfenstein* **NAME**

Perform your work **on separate paper and attach it**. Write your answers on this page. Answers must be **boxed or circled** and clearly **legible**. Where possible write answers as an **exact** integer or fraction otherwise use **two** decimal accuracy. Leave π in answers where applicable. **Units** required.

1) (a) 240° azi is marked on the compass. Convert it to a bearing. e.g. N 55° E. _____

(b) Mark S 70° E. Then convert it to its equivalent θ-angle (+deg) _____

(c) Mark $\theta = -250°$. Then convert it to its equivalent exact radian angle (+rad) _____

(d) Mark $(-7\pi/4)$ (e) Mark $(-\pi/3)$ (f) Mark $40\pi/3$ (g) Mark $-4520°$

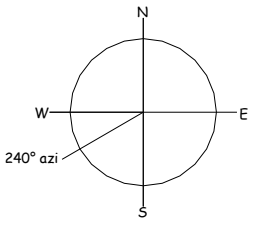


Fig 1

2) Through how many radians will each of the hands of a clock rotate from 12:00 midnight to 8:45 am? (leave π in answer)

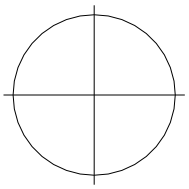
(a) H**our hand** _____ (b) **Minute hand** _____ (c) **Second hand** _____

3) How many degrees are there between the two hands of the clock at 7:25? (give the smaller angle)

4) (a) A pointer is at position $\theta = -220°$. Mark the initial position of the dial with -220°.

(b) From that position, the dial is rotated +2,540°. How many full rotations will the dial make?

(c) Mark the new final position with 'X'. Write the principle θ-angle here (+deg): _____



5) A ratchet turns a bolt 42° 30' with each pull.

(a) How many times must it be pulled to turn the bolt 20 revolutions?

(b) How many times must it be pulled to turn the bolt 25π rad?

6) A truck with 100 cm tires is traveling down the hi-way. The wheels are rotating at 480 rpm. A rock comes loose from the tire. How fast is the rock moving toward your windshield (m/sec)?

7) Road speed = 60 mph. Tire diameter=42" (a) What is the tire's rpm? (b) What is the tire's rad/sec?

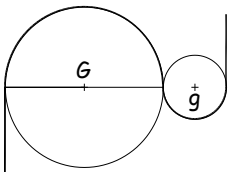
8) G = 42 cm, g = 12 cm. The large roller turns at 1620 rpm.

(a) What is the small roller's rpm?

(b) How fast is the belt moving (cm/sec)?

(c) How fast is the large roller rotating in rad/sec?

(d) How fast is the large roller rotating in deg/sec?



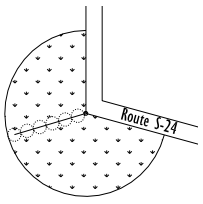
9) The pivot arm (radius) is 480'. Route S-24 make a 105° turn. 43,560 ft^2 = 1 ac.

(a) Find the area (in acres) watered by this pivot irrigation system.

(b) If you walked the curved perimeter of the field how far would you walk (ft)?

(c) The pivot arm covers the entire field in 5 days. Give its rotational speed in rad/hr.

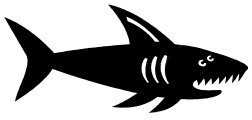
(d) Find the area covered by the pivot arm as sq-ft/hr.



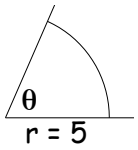
10) A 12 cm diameter reel has fishing line wound around which does not add appreciably to the diameter of the reel.

(a) How many radians must be wound on the reel to take-in 10 m of line?

(b) If the reel is turning at 20 rpm, what is the speed of the fish in m/sec?



11) Find the arc length when r = 5 and (a) $\theta = 20°$ (b) $\theta = 3\pi/4$



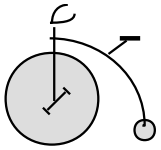
12) Find the length of cable wrapped around a 4" winch head if the cable is wrapped

(a) 1250° (b) $27\pi/5$

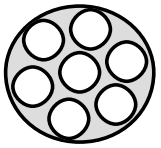
13) The large wheel has a 3' diameter and the small wheel has an 8" diameter.

(a) How many degrees will the large wheel turn when the small wheel rotates once?

(b) If the front wheel rotates at $25\pi/3$ rad/sec what is its rpm?



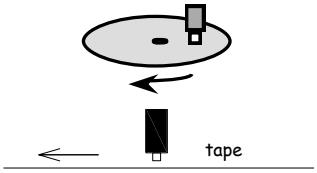
14) How much unused space (shaded area) will there be when seven 2" cables are tightly packed inside a pipe as shown (sq-in)?



15) The read/write head of a 3 1/2" computer hard drive is currently at the midpoint on the disc as shown. The disc is rotating at 2,400 rpm.

(a) What is the rotational speed in deg/sec?

(b) How fast must a straight tape move through its read/write head for the tape to match the speed of the disk at its read/write head (inches/min)?

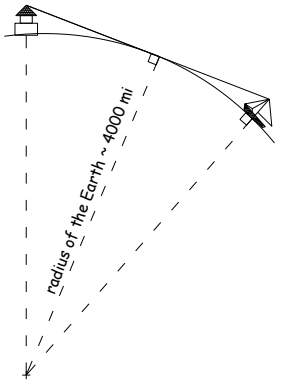


16) A Widow's walk is 115' above sea level.

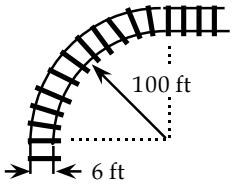
(a) How far (line of sight) to the horizon would you see from the Widow's Walk (mi)?

(b) Suppose a ship has a 32' mast. How far out will the mast tip first be visible (mi)?

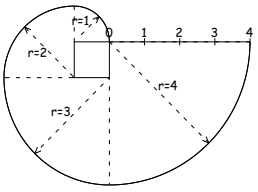
(c) Will the direct line of sight distance be the same as the actual distance on the Earth?



17) Find the difference (feet) between the lengths of the two rails.



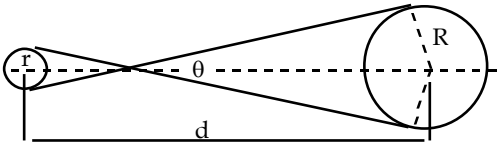
18) Find the length of the spiral.



19) r=10", R=18", d=68" Little disk rotates at 200 rpm.

(a) What is the rotational speed of the large disk in deg/sec?

(b) What is the speed of the belt (ft/sec)?



20) Estimate the distance from Budapest (47° 31' N, 19° E) to Cape Town (33° 54' S, 19° E) in miles. Use 3,960 mi for the Earth's radius.