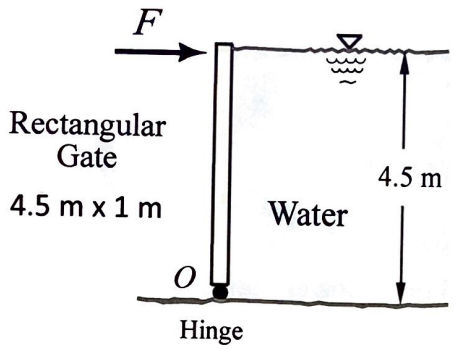
FUNDAMENTALS OF ENGINEERING
FINAL EXAM
FLUID PRESSURE
December 13, 2017

Problem: (Hydrostatic fluid pressure)



Fluid density

$\gamma_{water} = 1{,}000\ kg/m^3$

Perpendicular gate dimension = 1.0 meter

A rectangular gate has a frictionless pin (hinge) as shown in the figure. Using the listed data for the gate dimensions and the density of the fluid, answer the following questions:

(1) the magnitude of the resultant hydrostatic force (kN) acting on the gate is most nearly (width of the gate = 1 m)

(2) the magnitude of the force F (kN) required to keep the gate closed is most nearly:

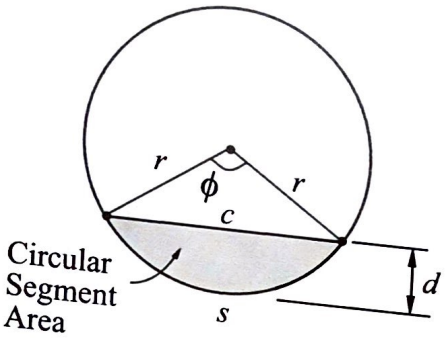
FUNDAMENTALS OF ENGINEERING

MATHEMATICS

AREA COMPUTATIONS

Problem: (Circular Segment)

FE/PE EXAMS



r = 12 cm. (Radius)
ϕ = 100° (Angle)

A circular segment is shown in the figure. Using the listed data for the radius and the angle, answer the following:

(1) The shaded area (cm^2) is most nearly:

(A) 61.5
(B) 39.6
(C) 48.7
(D) 54.8

$A_{segment} = ?$

(2) The arc length (s) in cm is most nearly:

(A) 26.4
(B) 20.9
(C) 17.6
(D) 15.3

$s = ?$

(3) The chord length (c) in cm is most nearly:

(A) 26.4
(B) 20.9
(C) 18.4
(D) 15.3

$c = ?$

Hint:
NCEES Reference Handbook, Page-24

(4) The depth (d) in cm is most nearly:

(A) 3.8
(B) 4.3
(C) 5.8
(D) 6.9

$d = ?$

Answers:

(1)	D
(2)	B
(3)	C
(4)	B

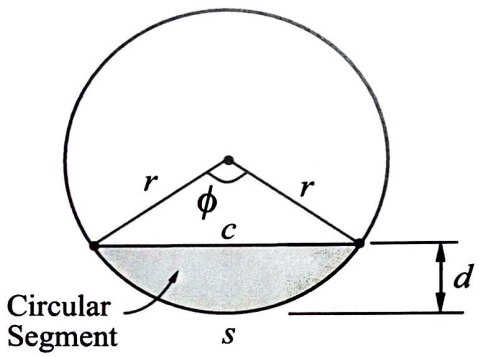
FUNDAMENTALS OF ENGINEERING

MATHEMATICS

CIRCULAR SEGMENT & CIRCULAR SECTOR

FE/PE EXAMS

Circular Segment



r = Radius
ϕ = Angle
s = Arc Length
c = Chord
d = Depth

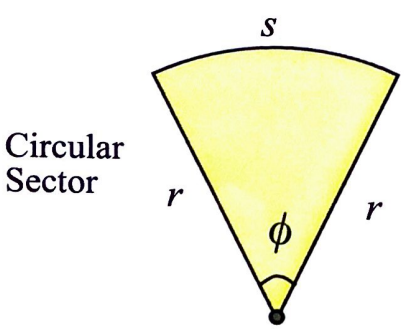
Circular segment is an area of a circle which is "cut off" from the rest of the circle by a secant (chord).

$$A = \frac{r^2}{2}\,(\phi - \sin\phi)$$

$$\phi = \frac{s}{r} = 2\left\{\arccos\left(\frac{r - d}{r}\right)\right\}$$

Circular Sector

NCEES Reference Handbook, Page-24



$$\phi = \frac{s}{r}$$

$$A = \frac{\phi\, r^2}{2} = \frac{s\, r}{2}$$

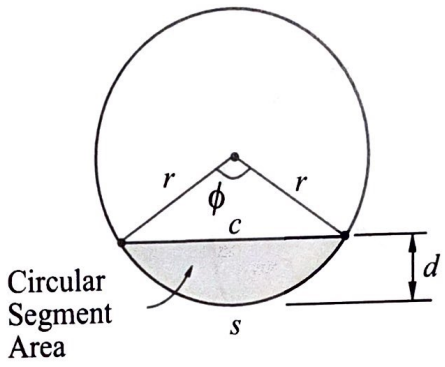
FUNDAMENTALS OF ENGINEERING

MATHEMATICS

AREA COMPUTATIONS

Problem: (Circular Segment)

FE/PE EXAMS



r = 9 cm. (Radius)
ϕ = 120° (Angle)

A circular segment is shown in the figure. Using the listed data for the radius and the angle, answer the following:

(1) The shaded area (cm^2) is most nearly:

(A) 28.5
(B) 35.6
(C) 49.8
(D) 62.5

$A_{segment} = ?$

(2) The arc length (s) in cm is most nearly:

(A) 23.8
(B) 20.5
(C) 18.8
(D) 12.2

$s = ?$

(3) The chord length (s) in cm is most nearly:

(A) 23.8
(B) 20.5
(C) 18.8
(D) 15.6

$c = ?$

Hint:
NCEES Reference Handbook, Page-24

(4) The depth (d) in cm is most nearly:

(A) 3.8
(B) 4.5
(C) 5.3
(D) 6.2

$d = ?$

Answers:

(1)	C
(2)	C
(3)	D
(4)	B