National 5 Mathematics

Properties of Shapes - **Solutions** - 2014-2017

Marks are indicated in brackets after each question number

2014 Paper 1 Question 12, (4)

Consider the right-angled triangle PAC

$PC = 15$ since it is the radius

$AC = 27 - 15 = 12$ since $CB = 15$

Using Pythagoras' Theorem gives

$(PC)^2 = (PA)^2 + (AC)^2$

$15^2 = (PA)^2 + 12^2$

$15^2 - 12^2 = (PA)^2$

$81 = (PA)^2$

$PA = 9$

So, $PQ = 2\,x\,9 = 18\,cm$

2014 Paper 2 Question 13, (5)

Area of sector MON $= \frac{50}{360}\,x\,\pi\,x\,7^2 = 21.4\,m^2$

Area of triangle MON $= \frac{1}{2}\,x\,7\,x\,7\,x\sin 50° = 18.8\,m^2$

Area of Chord at MN $= 2.6\,m^2$

Area of circle $= \pi\,x\,7^2 = 153.9\,m^2$

Area of cross-section $= 153.9 - 2.6 = 151.3\,m^2$

2015 Paper 1 Question 3, (3)

DFE $= 90°$ since triangle inscribed in a circle with one side being the diameter

So, FDE $= 180 - 90 - 64 = 26°$

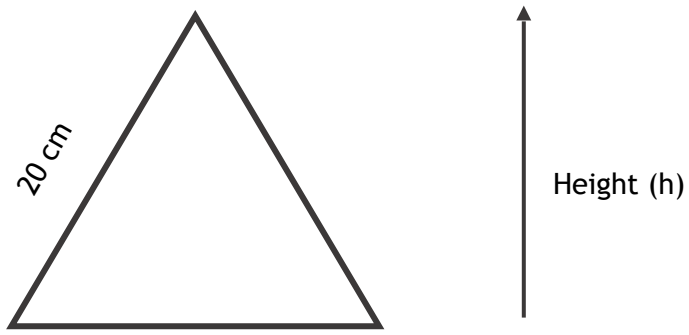
ABO $= 90°$ since tangent to the circle

So, OBD $= 90 - 77 = 13°$

And BDO $= 13°$ since isosceles triangle

So, BDF $= 26 + 13 = 39°$

2015 Paper 2 Question 11, (4)



20 cm

Using Pythagoras to calculate height gives

$20^2 = 10^2 + h^2$

$400 = 100 + h^2$

$300 = h^2$

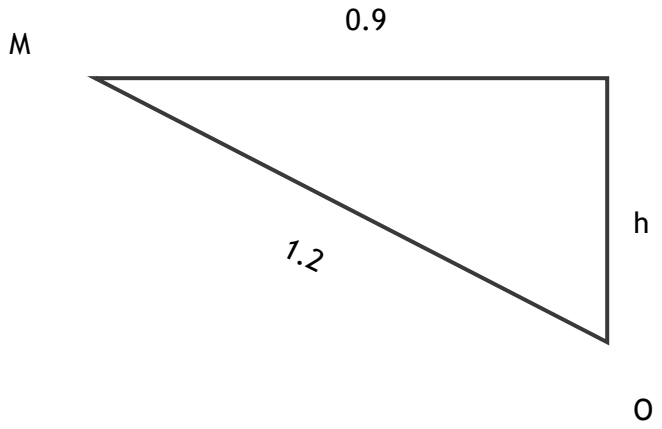
$h = \sqrt{300} = 17.32\ cm$

Area of triangle $= \frac{1}{2}\, x\, 17.32\, x\, 20 = 173.2\ cm^2$

Area of table top $= 173.2\, x\, 6 = 1,039.2\ cm^2$

2015 Paper 2 Question 12, (4)

Construct a right triangle from the midpoint of ML with O & M



Using Pythagoras gives

$1.2^2 = 0.9^2 + h^2$

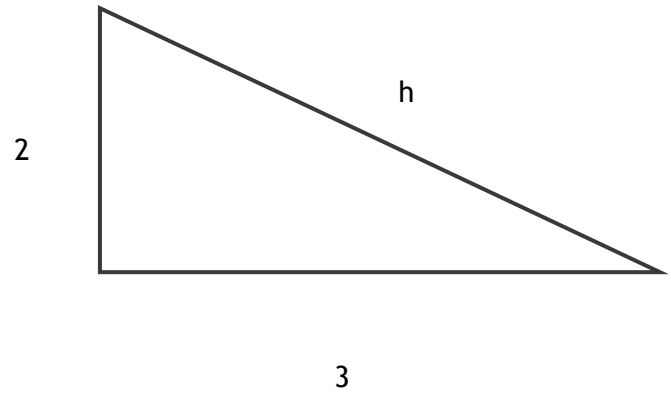
Solving gives $h = 0.79\ m$

So, depth of milk $= 0.79 + radius = 0.79 + 1.2 = 2.78\ m$

2016 Paper 1 Question 7, (1) (3)

a) $B = (8, 4, 0)$ by inspection of the graph

b) Create a right-angled triangle in the base



Using Pythagoras, we have

$$h = \sqrt{2^2 + 3^2} = \sqrt{13}$$

$$(AV)^2 = 6^2 + (\sqrt{13})^2$$
$$= 49$$
$$AV = 7$$

2016 Paper 2 Question 5, (3)

$EOA = 180 - 143 = 37°$

So, $OAC = 37°$ since Z angle

So, $CAB = 90 - 37 = 53°$ since tangent to circle makes $90°$ angle with radius

$ACB = 53°$ since same angle as CAB

So, $B = 180 - (53\ x\ 2) = 74°$

2016 Paper 2 Question 15, (4)

Let M be the midpoint of AB

$MB = 4.5$

Make a right triangle OMB giving

$6.6^2 = (OM)^2 + 4.5^2$ by Pythagoras

$(OM)^2 = 6.6^2 - 4.5^2 = 23.31$

$OM = \sqrt{23.31} = 4.8$ cm

Height = OM + radius

$= 4.8 + 6.6$

$= 11.4\ cm$

2017 Paper 1 Question 9, (3)

OBE $= 90°$

OBD $= 90 - 58 = 32°$

ODB $= 32°$ since isosceles triangle

DOB $= 180 - (32\ x\ 2) = 116°$

BOC $= 180 - 116 = 64°$

CAB $= 180 - 90 - 64 = 26°$

2017 Paper 2 Question 3, (3)

Using the Cosine Rule gives

$p^2 = q^2 + r^2 - 2qr\cos P$

$= 180^2 + 150^2 - 2\ x\ 180\ x\ 150\ x\cos 147$

$= 170, 380$

$p = \sqrt{170{,}380} = 413$

Length $= 413\ m$

2017 Paper 2 Question 13, (4)

Let C be the midpoint of AB

Then, $AC = 24\ cm$

Let D be the midpoint of AC

Then, $AD = 12\ cm$

Construct a right angled triangle A, $C_1,\ D$

Using Pythagoras gives

$14^2 + 12^2 = (DC_1)^2$

$196 + 144 = (DC_1)^2$

$DC_1 = \sqrt{340} = 7.2\ cm$

Height $= (7.2\ x\ 2) + (14\ x\ 2) = 42.4\ cm$