



CLASSIFIED WORKED SOLUTIONS

MATHEMATICS

(Paper 1 - All Variants)

(Syllabus 4024)

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period	2015 to 2025
contents	June & November, Paper 1 (All Variants) Worked Solutions
form	Topic By Topic
compiled for	O Levels

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Revision



June **2025** Paper 1 (All Variants)



November **2025** Paper 1 (All Variants)

TOPIC 1

Numbers

1. (a) Evaluate $\frac{3}{8} + 1\frac{1}{3}$.

Answer [1]

(b) Evaluate $5 - 3(2 - 1.4)$.

Answer [1]

[June/2015/P11/Q1]

2. Arrange these fractions in order, beginning with the smallest.

$$\frac{4}{5} \quad \frac{3}{4} \quad \frac{31}{40}$$

Answer , , [1]
smallest

[June/2015/P11/Q3(b)]

3. (a) Evaluate $\frac{1.3 + 2.9}{0.2}$.

Answer [1]

(b) Evaluate $2\frac{1}{4} \times \frac{1}{5}$.

Answer [1]

[June/2015/P12/Q1]

4. Write these numbers in order of size, starting with the smallest.

$$\frac{13}{20} \quad 0.7 \quad \frac{7}{12} \quad 0.64 \quad \frac{5}{8}$$

Answer , , , , [2]
smallest

[June/2015/P12/Q2]

5. (a) Express 60 as a product of its prime factors.

Answer [1]

- (b) Find the smallest possible integer m such that $60m$ is a square number.

Answer $m =$ [1]

- (c) The lowest number that is a multiple of both 60 and the integer n is 180 .

Find the smallest possible value of n .

Answer $n =$ [1]

[June/2015/P12/Q13]

6. (a) Work out $12 + 6 \div 3 + 1 \times 5$.

Answer [1]

- (b) Work out $\frac{7}{9} - \frac{3}{5}$.

Answer [1]

[Nov/2015/P11/Q1]

7. A number written as the product of its prime factors is $2^2 \times 5^2 \times 7$.

- (a) Evaluate this number.

Answer [1]

- (b) The lowest common multiple of $2^2 \times 5^2 \times 7$ and another number, N , is $2^2 \times 3 \times 5^2 \times 7^2$.
Find the lowest possible value of N .

Answer $N = \dots\dots\dots$ [1]

[Nov/2015/P11/Q3]

8. Here is a list of numbers.

−8 −5 −3 −2 0 2 4 9

- (a) Write down two numbers from the list that have a difference of 10.

Answer $\dots\dots\dots$ and $\dots\dots\dots$ [1]

- (b) Find the sum of the numbers in the list.

Answer $\dots\dots\dots$ [1]

- (c) It is given that $-4 \leq 2x \leq 7$.

Write down all the numbers from the list which satisfy this inequality.

Answer $\dots\dots\dots$ [1]

[Nov/2015/P11/Q10]

9. (a) Evaluate 0.03×0.3 .

Answer $\dots\dots\dots$ [1]

- (b) Evaluate $5 - 2(3 - 1.4)$.

Answer $\dots\dots\dots$ [1]

[Nov/2015/P12/Q1]

10. a , b , c , d and e are five numbers, such that

$$d < a < c$$

$$a < e < c$$

$$a < b < e$$

Arrange these numbers in order, starting with the smallest.

Answer $\dots\dots\dots$, $\dots\dots\dots$, $\dots\dots\dots$, $\dots\dots\dots$, $\dots\dots\dots$ [2]
smallest

[Nov/2015/P12/Q8]

11. (a) Express 198 as the product of its prime factors.

Answer [1]

(b) $M = 2^2 \times 3 \times 5^2$ $N = 2^3 \times 3^2 \times 7$

(i) Find the largest number that divides exactly into M and N .

Answer [1]

(ii) Find the smallest value of k , such that $M \times k$ is a cube number.

Answer $k =$ [1]

[Nov/2015/P12/Q12]

12. (a) Evaluate $12 - 6 \div 3 + 4$.

Answer [1]

(b) Evaluate 0.3×1.5 .

Answer [1]

[June/2016/P11/Q1]

13. (a) Evaluate $\frac{2}{3} - \frac{5}{8}$.

Answer [1]

(b) Evaluate $\frac{1}{3} \div \frac{7}{9}$, giving your answer as a fraction in its lowest terms.

Answer [1]

[June/2016/P11/Q2]

14. (a) Express 500 as the product of its prime factors.

Answer [1]

(b) $M = 2 \times 3^2$ $N = 2^4 \times 3^2$

Find the values of p and q when

(i) $M \times N = 2^p \times 3^q$,

Answer $p =$ $q =$ [1]

(ii) $M \div N = 2^p \times 3^q$,

Answer $p =$ $q =$ [1]

(iii) $N^2 = 2^p \times 3^q$.

Answer $p =$ $q =$ [1]

[June/2016/P11/Q21]

15. (a) Evaluate $(2.05 + 1.4) \times 0.2$.

Answer [1]

(b) Evaluate $1\frac{1}{3} - \frac{4}{5}$.

Answer [1]

[June/2016/P12/Q1]

16. Complete the table.

Fraction		Decimal		Percentage
$\frac{1}{2}$	=	0.5	=	50%
$\frac{3}{20}$	=		=	
.....	=		=	62.5%

[2]

[June/2016/P12/Q4]

17. (a) Express 96 as a product of its prime factors.

Answer [1]

(b) 24 is a common factor of 96 and the integer n .

Given that n is less than 96, find the largest possible value of n .

Answer [1]

[June/2016/P12/Q6]

18. Write these values in order of size, starting with the smallest.

$$2^5 \quad 5^2 \quad \sqrt[3]{1000} \quad 27^0$$

Answer,,, [1]
smallest

[June/2016/P12/Q13(a)]

19. (a) Evaluate $3\frac{1}{6} - 2\frac{3}{5}$.

Answer [1]

(b) Evaluate 0.03×0.11 .

Answer [1]

[Nov/2016/P11/Q1]

20. (a) Express $32\frac{1}{2}\%$ as a fraction in its simplest form.

Answer [1]

(b) Arrange these values in order of size, starting with the smallest.

$$0.38 \quad \frac{9}{25} \quad 0.4 \quad \frac{7}{20}$$

Answer , , , [1]
smallest

[Nov/2016/P11/Q3]

ANSWERS

Topic 1 - Numbers

1. (a) $\frac{3}{8} + 1\frac{1}{3} = \frac{3}{8} + \frac{4}{3} = \frac{41}{24}$
(b) $5 - 3(2 - 1.4) = 5 - 1.8 = 3.2$
2. $\frac{4}{5} \quad \frac{3}{4} \quad \frac{31}{40}$
 $= 0.8 \quad 0.75 \quad 0.775 \Rightarrow \frac{3}{4} \quad \frac{31}{40} \quad \frac{4}{5}$
3. (a) $\frac{1.3 + 2.9}{0.2} = \frac{4.2}{0.2} = \frac{42}{2} = 21$
(b) $2\frac{1}{4} \times \frac{1}{5} = \frac{9}{4} \times \frac{1}{5} = \frac{9}{20}$
4. $\frac{13}{20} \quad 0.7 \quad \frac{7}{12} \quad 0.64 \quad \frac{5}{8}$
 $= 0.65 \quad 0.7 \quad 0.583 \quad 0.64 \quad 0.625$
 $\therefore \frac{7}{12}, \frac{5}{8}, 0.64, \frac{13}{20}, 0.7$
5. (a) $60 = 2^2 \times 3 \times 5$
(b) $60m = 2^2 \times 3 \times 5 \times (3 \times 5). \therefore m = 15$
(c) $60 = 2 \times 2 \times 3 \times 5, 180 = 2 \times 2 \times 3 \times 3 \times 5$
 $\therefore$ smallest value of $n = 3 \times 3 = 9$
6. (a) $12 + 6 \div 3 + 1 \times 5 = 12 + 2 + 5 = 19$
(b) $\frac{7}{9} - \frac{3}{5} = \frac{8}{45}$
7. (a) $2^2 \times 5^2 \times 7 = 4 \times 25 \times 7 = 700$
(b) $700 = 2^2 \times 5^2 \times 7. \text{ LCM} = 2^2 \times 3 \times 5^2 \times 7^2.$
 $\therefore$ Lowest value of $N = 3 \times 7^2 = 147$
8. (a) 2 and -8.
(b) $-8 - 5 - 3 - 2 + 0 + 2 + 4 + 9 = -3$
(c) $-4 \leq 2x \leq 7 \Rightarrow -2 \leq x \leq 3.5$
 $\therefore$ Numbers are, -2, 0, 2
9. (a) $0.03 \times 0.3 = 0.009$
(b) $5 - 2(3 - 1.4) = 5 - 2(1.6) = 1.8$
10. $d < a < b < e < c$
11. (a) $198 = 2 \times 3^2 \times 11$
(b) (i) GCD of M and $N = 2^2 \times 3 = 12$
(ii) $M \times k = 2^2 \times 3 \times 5^2 \times (2 \times 3^2 \times 5)$
 $\therefore k = 2 \times 3^2 \times 5 = 90$
12. (a) $12 - 6 \div 3 + 4 = 12 - 2 + 4 = 14$
(b) $0.3 \times 1.5 = 0.45$
13. (a) $\frac{2}{3} - \frac{5}{8} = \frac{1}{24}$
(b) $\frac{1}{3} \div \frac{7}{9} = \frac{1}{3} \times \frac{9}{7} = \frac{3}{7}$
14. (a) $500 = 2 \times 2 \times 5 \times 5 \times 5 = 2^2 \times 5^3$
(b) (i) $M \times N = 2^5 \times 3^4. \therefore p = 5, q = 4$
(ii) $M \div N = \frac{2 \times 3^2}{2^4 \times 3^2} = 2^{-3} \times 3^0,$
 $\therefore p = -3, q = 0$
(iii) $N^2 = 2^8 \times 3^4. \therefore p = 8, q = 4$
15. (a) $(2.05 + 1.4) \times 0.2 = 3.45 \times 0.2 = 0.69$
(b) $1\frac{1}{3} - \frac{4}{5} = \frac{4}{3} - \frac{4}{5} = \frac{20 - 12}{15} = \frac{8}{15}$
16.

Fraction	Decimal	Percentage
$\frac{1}{2}$	= 0.5	= 50%
$\frac{3}{20}$	= 0.15	= 15%
$\frac{5}{8}$	= 0.625	= 62.5%
17. (a) $96 = 2 \times 2 \times 2 \times 2 \times 3 = 2^5 \times 3$
(b) n is a multiple of 24. Thus, the largest value of n less than $96 = 24 \times 3 = 72$

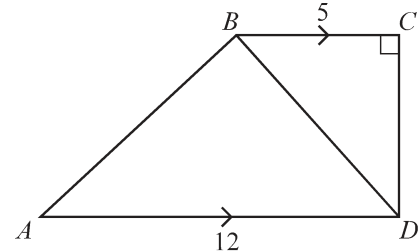
18. $2^5 = 32$, $5^2 = 25$, $\sqrt[3]{1000} = 10$, $27^0 = 1$
 $\therefore 27^0, \sqrt[3]{1000}, 5^2, 2^5$
19. (a) $3\frac{1}{6} - 2\frac{3}{5} = \frac{19}{6} - \frac{13}{5} = \frac{17}{30}$
 (b) $3 \times 11 = 33$
 $\therefore 0.03 \times 0.11 = 0.0033$
20. (a) $32\frac{1}{2}\% = \frac{65}{2} \times \frac{1}{100} = \frac{13}{40}$
 (b) $0.38 = 0.38$, $\frac{9}{25} = 0.36$, $0.4 = 0.4$, $\frac{7}{20} = 0.35$
 $\therefore \frac{7}{20}, \frac{9}{25}, 0.38, 0.4$
21. (a) $9.03 - (4.273 + 2.3) = 9.03 - 6.573 = 2.457$
 (b) $\frac{8}{9} - \frac{6}{7} = \frac{56 - 54}{63} = \frac{2}{63}$
22. (a) $0.192 \times 643 = \frac{192}{1000} \times (64.3 \times 10)$
 $= \frac{12345.6}{100} = 123.456$
 (b) $\frac{12.3456}{192} = \frac{12345.6}{192} \times \frac{1}{1000}$
 $= 64.3 \times \frac{1}{1000} = 0.0643$
23. $74\% = 0.74$, $-0.7 = -0.7$, $0.7 = 0.7$, $-\frac{3}{4} = -0.75$
 $\therefore -\frac{3}{4}, -0.7, 0.7, 74\%$
24. (a) $0.2 \times 0.08 = 0.016$
 (b) $2 \times (3 + 4) \times 5 = 70$
25. (a) $36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$
 (b) 2 and 13
26. (a) $\frac{3}{5} - \frac{1}{8} = \frac{24 - 5}{40} = \frac{19}{40}$
 (b) $A \times \frac{3}{7} = \frac{2}{5} \Rightarrow A = \frac{2}{5} \times \frac{7}{3} = \frac{14}{15}$
 (c) $\left(\frac{5}{8} + \frac{2}{3}\right) \times \frac{1}{2} = \frac{31}{24} \times \frac{1}{2} = \frac{31}{48}$
27. (a) $\frac{4}{5} - \frac{1}{3} = \frac{12 - 5}{15} = \frac{7}{15}$
 (b) $2 \times 6 = 12$. $\therefore 0.2 \times 0.006 = 0.0012$
28. (i) $54 = 2 \times 3 \times 3 \times 3$
 (ii) $54m = 2 \times 3^3 \times (2^2)$. $\therefore m = 4$
29. (a) $1\frac{3}{8} - \frac{2}{3} = \frac{11}{8} - \frac{2}{3} = \frac{17}{24}$
 (b) $0.4 \times 1.3 = 0.52$
30. (a) $\frac{6}{7} - \frac{3}{5} = \frac{30 - 21}{35} = \frac{9}{35}$
 (b) $\frac{90}{0.45} \times \frac{100}{100} = \frac{90 \times 100}{45} = 200$
31. (a) $\frac{3.5 - 1.9}{0.8} = \frac{1.6}{0.8} = \frac{16}{8} = 2$
 (b) $9 + (6 \div 3) - 4 = 9 + 2 - 4 = 7$
32. (a) $\frac{15}{100} \times 80 = 12$ (b) $\frac{3}{5} - \frac{2}{7} = \frac{11}{35}$
33. $\frac{1}{3} = 0.333$, $0.32 = 0.32$, $\frac{15}{40} = 0.375$, $0.3 = 0.3$, $\frac{9}{31} = 0.29$
 $\therefore \frac{9}{31}, 0.3, 0.32, \frac{1}{3}, \frac{15}{40}$
34. (a) $\frac{4}{11} - \frac{2}{7} = \frac{28 - 22}{77} = \frac{6}{77}$
 (b) $0.9 \times 0.011 = \frac{9}{10} \times \frac{11}{1000} = 0.0099$
35. (a) $-1.2, -0.3, 0.05, 0.2, 1.3$
 (b) (i) $\frac{-1.2 - 0.3 + 0.05 + 0.2 + 1.3}{5} = 0.01$
 (ii) Range, $1.3 - (-1.2) = 2.5$
36. (a) $\frac{2}{7} + \frac{1}{5} = \frac{17}{35}$ (b) $\frac{2}{5} \times 1\frac{1}{5} = \frac{2}{5} \times \frac{6}{5} = \frac{12}{25}$
37. (a) $17\frac{1}{2}\% = \frac{35}{2} \times \frac{1}{100} = \frac{7}{40}$
 (b) $6 + 4(1 - 0.4) = 6 + 2.4 = 8.4$
38. (a) $\sqrt{19}$ (b) Final digit = 4
39. (a) $1200 = 2^4 \times 3 \times 5^2$
 (b) $120n = 2^3 \times 3 \times 5 \times (2 \times 3 \times 5)$. $\therefore n = 30$

TOPIC 28

Mensuration

1. $ABCD$ is a quadrilateral with BC parallel to AD .
 CD is perpendicular to BC . $BC = 5$ cm and $AD = 12$ cm.
 The area of triangle BCD is 20 cm².

(a) Find CD .



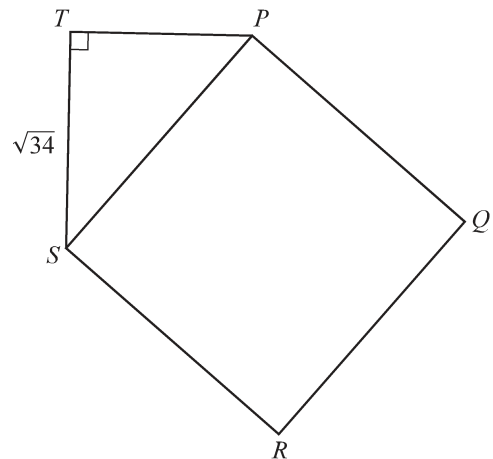
Answer cm [1]

(b) Find the area of triangle ABD .

Answer cm² [1]

[Nov/2015/P11/Q2]

2. The diagram shows a square $PQRS$ and a right-angled triangle PST . The area of the square is 50 cm².
 $ST = \sqrt{34}$ cm. Calculate PT .

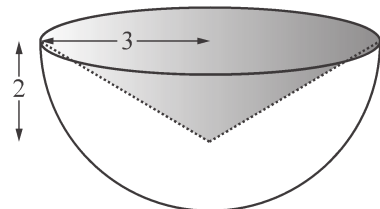


Answer cm [2]

[Nov/2015/P11/Q5]

3. [The volume of a sphere is $\frac{4}{3}\pi r^3$] [The volume of a cone is $\frac{1}{3}\pi r^2 h$]

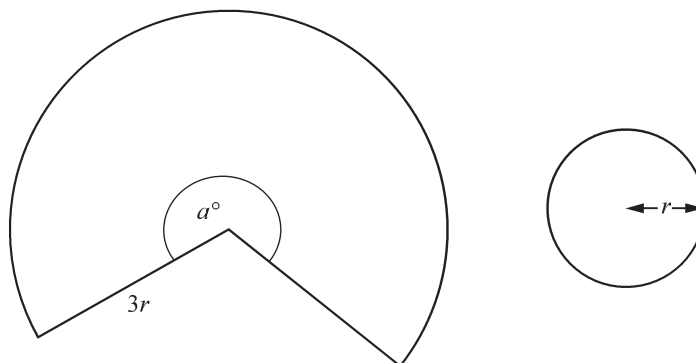
A cone is removed from a solid wooden hemisphere of radius 3 cm.
 The cone has radius 3 cm and height 2 cm.
 The volume of wood remaining is $k\pi$ cm³.
 Find k .



Answer $k =$ [3]

[June/2016/P11/Q14]

4.



The diagram shows a sector of a circle with radius $3r$ cm and angle a° and a circle with radius r cm.

The ratio of the area of the sector to the area of the circle with radius r cm is 8 : 1.

(a) Find the value of a .

Answer $a = \dots\dots\dots$ [3]

(b) Find an expression, in terms of π and r , for the perimeter of the sector.

Answer $\dots\dots\dots$ cm [2]

[June/2016/P12/Q24]

5. [The volume of a sphere is $\frac{4}{3}\pi r^3$]

During a storm, raindrops fall into a cylinder which stands on horizontal ground.

The cylinder was empty before the storm started.

The cylinder has radius 20 mm.

Each raindrop is a sphere of radius 2 mm.

After the storm, the depth of water in the cylinder is 16 mm.

Calculate the number of raindrops that fell into the cylinder.

Answer $\dots\dots\dots$ [3]

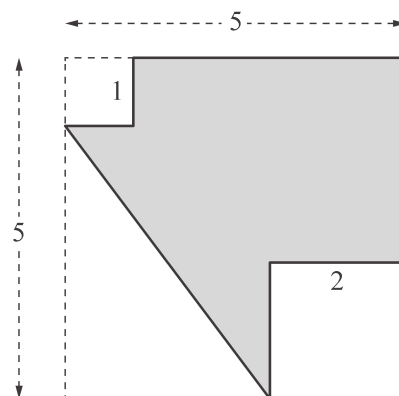
[Nov/2016/P12/Q21]

6. The diagram shows a square piece of card, from which a triangle and two small squares are removed. All lengths on the diagram are in centimetres.

(a) Calculate the area of the shaded card.

Answer cm² [2]

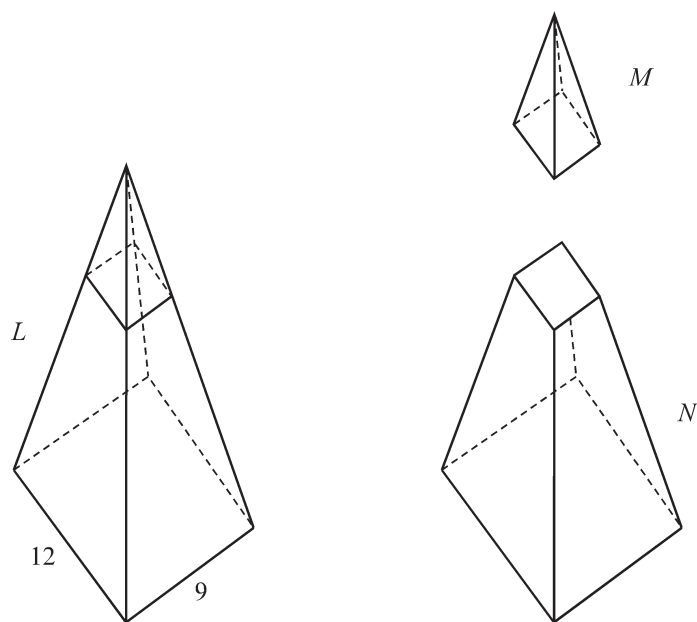
(b) Calculate the perimeter of the shaded card.



Answer cm [2]

[Nov/2016/P12/Q23]

7. [Volume of a pyramid = $\frac{1}{3} \times \text{base area} \times \text{perpendicular height}$]



The diagrams show a solid pyramid L cut into two parts, M and N , by a plane parallel to its base. The base of pyramid L is a rectangle 9 cm by 12 cm. The perpendicular height of pyramid L is 30 cm.

(a) Work out the volume of pyramid L .

Answer cm³ [1]

(b) The perpendicular height of pyramid M is $\frac{1}{3}$ of the perpendicular height of pyramid L .

(i) Express the volume of M as a fraction of the volume of L .

Answer [1]

(ii) Calculate the volume of the solid N .

Answer cm^3 [2]

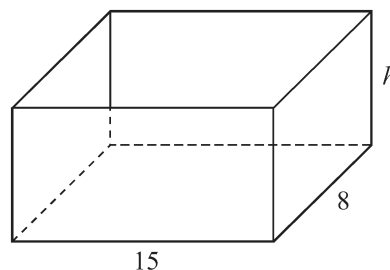
[June/2017/P11/Q15]

8. A container is made out of thin material in the shape of a cuboid with an open top.

The container has length 15 cm and width 8 cm.

The volume of the container is 720 cm^3 .

(a) Calculate the height, h cm, of the container.



Answer cm [2]

(b) Calculate the surface area of the **outside** of the container.

Answer cm^2 [2]

(c) Liquid is poured into the container.

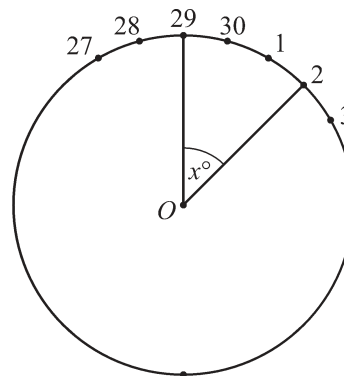
The liquid fills 60% of the container.

Calculate the height of the liquid in the container.

Answer cm [1]

[June/2017/P12/Q22]

9. The diagram represents a vertical, circular fairground wheel which turns about its centre O .
 The wheel has 30 seats, equally spaced around the circumference, numbered consecutively from 1 to 30.
 The diagram, which is not drawn to scale, shows seven of the seats, labelled with the seat number.
 The seat number 29 is at the top of the wheel.
- (a) What is the number of the seat which is at the bottom of the wheel?



Answer [1]

- (b) Calculate the angle x° , as shown on the diagram.

Answer [1]

- (c) Work out the angle of elevation of seat 2 from the bottom of the wheel.

Answer [2]

[Nov/2017/P11/Q18]

10. An **open** rectangular tray has inside measurements
 length 11 cm width 6 cm height 5 cm.

- (a) Calculate the total surface area of the four sides and base of the inside of the tray.



Answer cm^2 [2]

- (b) Cubes are placed in the tray and a lid is placed on top.
 Each cube has an edge of 2 cm.
 Find the maximum number of cubes that can be placed in the tray.

Answer [1]

[Nov/2017/P12/Q18]

ANSWERS

Topic 28 - Mensuration

1. (a) Area of $\triangle BCD = \frac{1}{2}(5)(CD)$
 $\Rightarrow 20 = \frac{1}{2}(5)(CD) \Rightarrow CD = 8 \text{ cm}$

(b) Area of $\triangle ABD = \frac{1}{2}(12)(8) = 48 \text{ cm}^2$

2. Area of square, $l^2 = 50 \Rightarrow l = \sqrt{50}$
 Using Pythagoras on $\triangle PST$,
 $PT^2 = (\sqrt{50})^2 - (\sqrt{34})^2 \Rightarrow PT = 4 \text{ cm}$

3. Vol. of wood = Vol._{hemisphere} - Vol._{cone}
 $\Rightarrow k\pi = \frac{1}{2}\left(\frac{4}{3}\pi(3)^3\right) - \left(\frac{1}{3}\pi(3)^2(2)\right)$
 $\Rightarrow k\pi = 18\pi - 6\pi \Rightarrow k = 12$

4. (a) $\frac{\text{Area of sector}}{\text{Area of circle}} = \frac{8}{1}$
 $\Rightarrow \frac{\frac{a^\circ}{360} \times \pi(3r)^2}{\pi r^2} = \frac{8}{1} \Rightarrow a^\circ = 320^\circ$

(b) Perimeter = length of arc + $3r + 3r$
 $= \frac{320^\circ}{360^\circ} \times 2\pi(3r) + 6r = \frac{16\pi r}{3} + 6r$

5. Vol. of water in the cylinder = $\pi(20)^2(16)$
 $= 6400\pi \text{ mm}^3$
 Vol. of one raindrop = $\frac{4}{3}\pi(2)^3 = \frac{32}{3}\pi \text{ mm}^3$
 $\therefore \text{Number of raindrops} = \frac{6400\pi}{\frac{32}{3}\pi} = 600$

6. (a) Shaded area = area of larger square - (area of 2 small squares + area of $\triangle$)
 $= (5)^2 - \left((1)^2 + (2)^2 + \frac{1}{2}(3)(4)\right) = 14 \text{ cm}^2$
 (b) By Pythagoras, slant ht. of $\triangle = \sqrt{3^2 + 4^2} = 5 \text{ cm}$
 Perimeter = $5 + 2 + 2 + 3 + 4 + 1 + 1 = 18 \text{ cm}$

7. (a) Volume of $L = \frac{1}{3} \times (9 \times 12) \times 30 = 1080 \text{ cm}^3$

(b) (i) Height of $M = \frac{1}{3} \times 30 = 10 \text{ cm}$
 $\therefore \frac{\text{Volume of } M}{\text{Volume of } L} = \left(\frac{10}{30}\right)^3 = \frac{1}{27}$

(ii) Vol. of $M = \frac{1}{27} \times \text{Vol. of } L$
 $= \frac{1}{27} \times 1080 = 40 \text{ cm}^3$
 $\therefore \text{Vol. of } N = 1080 - 40 = 1040 \text{ cm}^3$

8. (a) Vol. of cuboid = $15 \times 8 \times h$
 $\Rightarrow 720 = 15 \times 8 \times h \Rightarrow h = 6 \text{ cm.}$

(b) Surface area = $(15 \times 8) + 2(15 \times 6) + 2(8 \times 6)$
 $= 396 \text{ cm}^2$

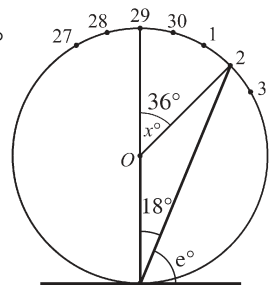
(c) Volume of liquid = $\frac{60}{100} \times 720 = 432 \text{ cm}^3$
 $\Rightarrow 15 \times 8 \times h = 432 \Rightarrow h = 3.6 \text{ cm}$

9. (a) Seat number 14.

(b) The sector has 3 spaces between seats.
 So there are $\frac{30}{3} = 10$ sectors in the circle.

$\therefore x^\circ = \frac{360^\circ}{10} = 36^\circ$

(c) From figure,
 angle of elevation
 $= 90^\circ - 18^\circ = 72^\circ$



10. (a) Surface area = $(11 \times 6) + 2(11 \times 5) + 2(6 \times 5)$
 $= 236 \text{ cm}^2$

(b) Number of cubes that fill the length = 5
 Number of cubes that fill the width = 3
 Number of cubes that fill the height = 2
 $\therefore \text{Total No. of cubes} = 5 \times 3 \times 2 = 30$

11. By Pythagoras, $BC = \sqrt{6^2 + 7^2} = \sqrt{85}$
 Req. Area $= (\sqrt{85})^2 + \frac{1}{2}(6)(7) = 106 \text{ cm}^2$

12. (a) $20 \times 40 \times h = 2400 \Rightarrow h = 3 \text{ cm}$

(b) Volume $= 1000 \times 2400$
 $= 2400000 \text{ cm}^3 = \frac{2400000}{1000000} = 2.4 \text{ m}^3$

(c) $\frac{\text{Vol. of bigger slab}}{2400} = \left(\frac{60}{40}\right)^3$
 Vol. of bigger slab $= \frac{27}{8} \times 2400 = 8100 \text{ cm}^3$

13. Length of base $= y \text{ cm}$, height $= 2y \text{ cm}$
 Total surface area $= 2(y^2) + 4(y \times 2y)$
 $\Rightarrow 360 = 10y^2 \Rightarrow y = 6 \text{ cm}$
 $\therefore$ height of the cuboid $= 2(6) = 12 \text{ cm}$.

14. Shaded area of sector $AOB = \frac{60}{360} \pi 3^2 = \frac{3}{2} \pi$
 Empty area of $AOB = \frac{60}{360} (\pi)(6^2 - 3^2) = \frac{9}{2} \pi$
 Total area of ring $= \pi(6^2 - 3^2) = 27\pi$
 $\therefore$ Total shaded area $= 27\pi + \frac{3}{2} \pi - \frac{9}{2} \pi$
 $\Rightarrow k\pi = 27\pi + \frac{3}{2} \pi - \frac{9}{2} \pi \Rightarrow k = 24$

15. Total vol. of 400 drops $= 0.08 \times 400 = 32 \text{ cm}^3$
 Volume of cuboid $= 5 \times 4 \times h$
 $\Rightarrow 32 = 20h \Rightarrow h = 1.6 \text{ cm}$
 $\therefore$ change in water level $= 1.6 \text{ cm}$.

16. $6^2 = l \times 4 \Rightarrow l = 9 \text{ cm}$. Also, $TU = 3 \text{ cm}$
 Perimeter $= 6 + 4 + 9 + 4 + 3 + 6 + 6 = 38 \text{ cm}$.

17. $\pi(28)(y) = 2\pi(15)(42)$
 $\Rightarrow y = \frac{2(15)(42)}{28} = 45 \text{ cm}$.

18. Area of trapezium $= 85 \text{ cm}^2$
 $\Rightarrow \frac{1}{2}(h)(7 + 10) = 85$
 $\Rightarrow \frac{17}{2}h = 85 \Rightarrow h = 10 \text{ cm}$.

19. (a) Let l be the length of edge of 2nd cube.

Total volume of 2 cubes $= 5^3 + l^3$

$\Rightarrow 152 = 5^3 + l^3$

$\Rightarrow 152 = 125 + l^3$

$\Rightarrow l^3 = 27 \Rightarrow l = 3 \text{ cm}$

(b) A cube has 12 edges

$\therefore$ Total length of all edges $= 5 \times 12 = 60 \text{ cm}$

20. $85 \text{ mm}^2 = \frac{85}{100} \text{ cm}^2 = 0.85 \text{ cm}^2$

$\therefore$ Shaded area $= 9 - 0.85 = 8.15 \text{ cm}^2$

21. Area of sector $= \frac{360^\circ - 80^\circ}{360^\circ} \times \pi(3)^2$
 $= \frac{280^\circ}{360^\circ} \times \pi(9) = 7\pi \text{ cm}^2$

22. (a) Slant height of cone is,

$l = y + \frac{25}{100}(y) = \frac{125}{100}y = \frac{5}{4}y \text{ cm}$

Given that,

Surface area of sphere
 $=$ total surface area of cone.

$\Rightarrow 4\pi R^2 = \pi y^2 + \pi(y)\left(\frac{5}{4}y\right)$

$\Rightarrow 4\pi R^2 = \pi y^2 + \frac{5}{4}\pi y^2$

$\Rightarrow 4\pi R^2 = \frac{9}{4}\pi y^2$

$\Rightarrow 16R^2 = 9y^2$

$\Rightarrow y^2 = \frac{16R^2}{9} \Rightarrow y = \frac{4R}{3}$

(b) By Pythagoras, height of cone is,

$h = \sqrt{\left(\frac{5}{4}y\right)^2 - y^2} = \sqrt{\frac{9}{16}y^2} = \frac{3}{4}y \text{ cm}$

Volume of cone $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi y^2 \left(\frac{3}{4}y\right)$

$= \frac{1}{4}\pi y^3$ (Subst. $y = \frac{4R}{3}$ from (a))

$= \frac{1}{4}\pi \left(\frac{4R}{3}\right)^3$

$= \frac{1}{4}\pi \left(\frac{64R^3}{27}\right) = \frac{16\pi R^3}{27} \text{ cm}^3$

TOPIC 27

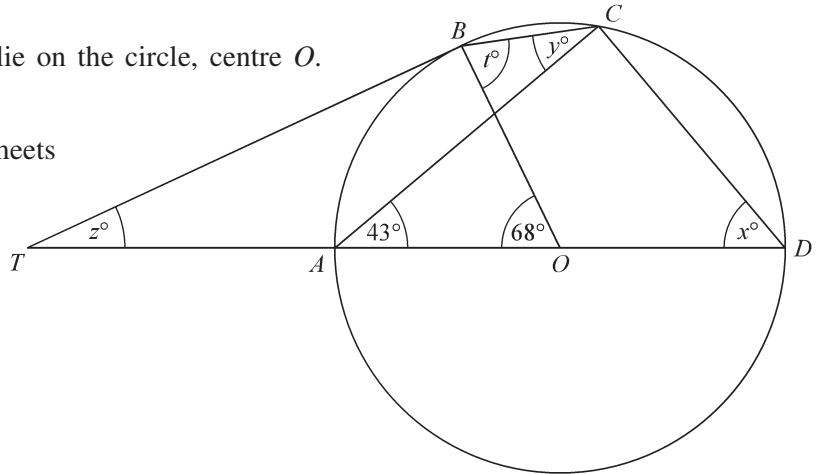
Circle Properties

1. In the diagram, A , B , C and D lie on the circle, centre O .

AD is a diameter.

The tangent to the circle at B meets the line DA produced at T .

$\angle AOB = 68^\circ$ and $\angle CAO = 43^\circ$.



- (a) Find x .

Answer $x = \dots\dots\dots$ [1]

- (b) Find y .

Answer $y = \dots\dots\dots$ [1]

- (c) Find z .

Answer $z = \dots\dots\dots$ [1]

- (d) Find t .

Answer $t = \dots\dots\dots$ [1]

[June/2015/P11/Q19]

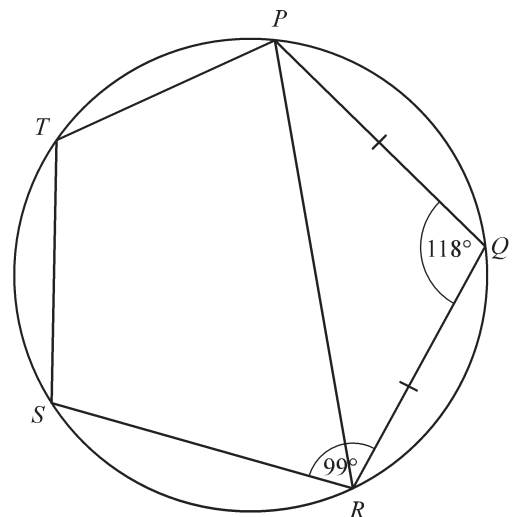
2. (a) P , Q , R , S and T are points on the circumference of a circle.

$PQ = QR$.

$\angle PQR = 118^\circ$ and $\angle QRS = 99^\circ$.

Find $\angle PTS$.

Show all your working.

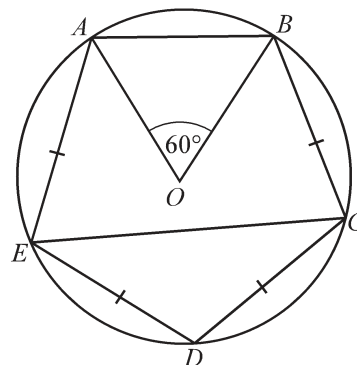


Answer $\angle PTS = \dots\dots\dots$ [2]

- (b) A, B, C, D and E are points on the circumference of a circle, centre O .

$$AE = ED = DC = CB \text{ and } \angle AOB = 60^\circ.$$

- (i) Find $\angle ECD$.
Show all your working.



Answer $\angle ECD = \dots\dots\dots$ [2]

- (ii) The radius of the circle is 12 cm.
Calculate the length of the minor arc AB .
Use $\pi = 3.14$.

Answer $\dots\dots\dots$ cm [2]

[Nov/2015/P11/Q24]

3. In the diagram, A, B, C, D and E lie on the circle, centre O .

AC is a diameter.

The tangent to the circle at C meets the line AB produced at T .

$$\angle ACB = 62^\circ \text{ and } \angle ACD = 70^\circ.$$

- (a) Find x .

Answer $x = \dots\dots\dots$ [1]

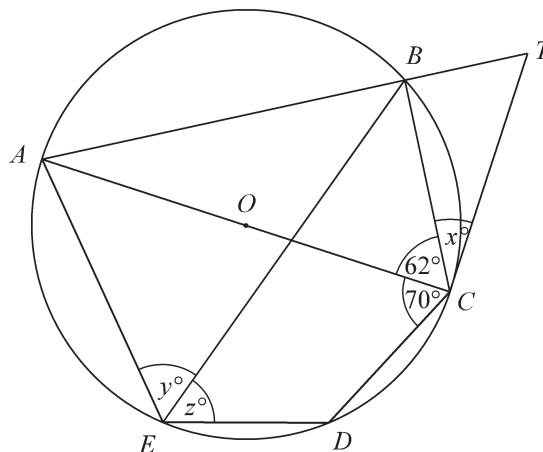
- (b) Find y .

Answer $y = \dots\dots\dots$ [1]

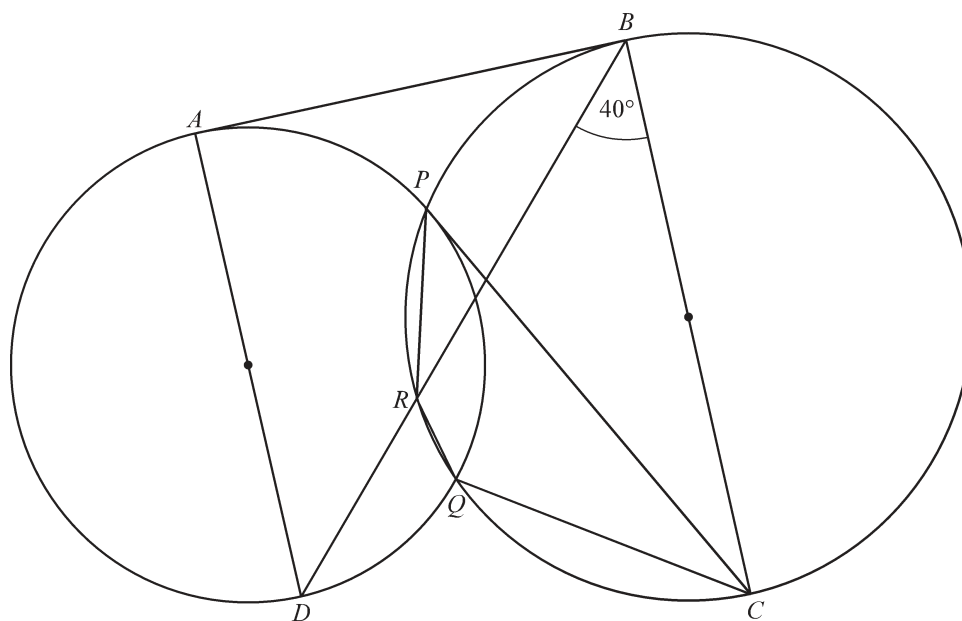
- (c) Find z .

Answer $z = \dots\dots\dots$ [1]

[Nov/2015/P12/Q17]



4.



In the diagram, the two circles intersect at P and Q .
 The line AB is a tangent to the circles at A and B .
 AD and BC are diameters.
 BD intersects the larger circle at R .

$$\widehat{DBC} = 40^\circ.$$

(a) Find $\widehat{CPR}$.

Answer $\widehat{CPR} = \dots\dots\dots$ [1]

(b) Find $\widehat{CQR}$.

Answer $\widehat{CQR} = \dots\dots\dots$ [1]

(c) Find $\widehat{ABD}$.

Answer $\widehat{ABD} = \dots\dots\dots$ [1]

(d) Find $\widehat{ADB}$.

Answer $\widehat{ADB} = \dots\dots\dots$ [1]

[June/2016/P11/Q19]

5. In the diagram, the points A, B, C, D and E lie on the circle centre O .
 AD is a diameter.

$$\widehat{DAC} = 33^\circ \text{ and } \widehat{ACE} = 70^\circ.$$

- (a) Find $\widehat{CDA}$.

$$\text{Answer } \widehat{CDA} = \dots\dots\dots [1]$$

- (b) Find $\widehat{DEC}$.

$$\text{Answer } \widehat{DEC} = \dots\dots\dots [1]$$

- (c) Find $\widehat{ABC}$.

$$\text{Answer } \widehat{ABC} = \dots\dots\dots [1]$$

- (d) Find reflex $\widehat{EOA}$.

$$\text{Answer reflex } \widehat{EOA} = \dots\dots\dots [1]$$

[Nov/2016/P11/Q17]

6. In the diagram, A, B, C, D and E lie on the circle, centre O .

BOE is a straight line.

$$\widehat{DAB} = 34^\circ.$$

- (a) Find x .

$$\text{Answer } x = \dots\dots\dots [1]$$

- (b) Find y .

$$\text{Answer } y = \dots\dots\dots [1]$$

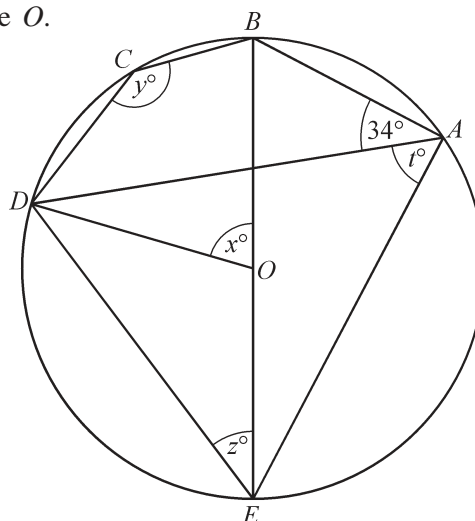
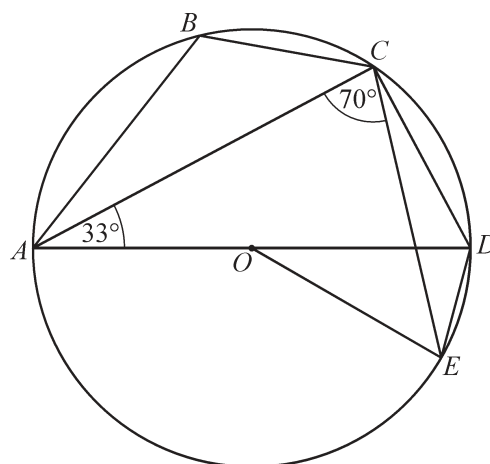
- (c) Find z .

$$\text{Answer } z = \dots\dots\dots [1]$$

- (d) Find t .

$$\text{Answer } t = \dots\dots\dots [1]$$

[Nov/2016/P12/Q24]

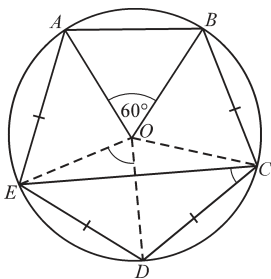


ANSWERS

Topic 27 - Circle Properties

1. (a) $\triangle ACD$ is a right angled $\triangle$,
 $\therefore x^\circ = 90^\circ - 43^\circ = 47^\circ$
 (b) $y^\circ = \frac{1}{2}(68^\circ) = 34^\circ$
 (c) $\triangle OBT$ is a right angled $\triangle$,
 $\therefore z^\circ = 90^\circ - 68^\circ = 22^\circ$
 (d) $\widehat{BOD} = 180^\circ - 68^\circ = 112^\circ$,
 $\widehat{BCD} = 90^\circ + 34^\circ = 124^\circ$
 In quadrilateral $OBCD$
 $t^\circ + 124^\circ + 47^\circ + 112^\circ = 360^\circ \Rightarrow t^\circ = 77^\circ$
2. (a) In $\triangle PQR$, $\widehat{QRP} = \frac{180^\circ - 118^\circ}{2} = 31^\circ$
 $\therefore \widehat{PRS} = 99^\circ - 31^\circ = 68^\circ$
 $PRST$ is a cyclic quadrilateral,
 $\therefore \widehat{PTS} = 180^\circ - 68^\circ = 112^\circ$
 (b) (i) From figure,

$$\widehat{EOD} = \frac{360^\circ - 60^\circ}{4} = 75^\circ$$

$$\therefore \widehat{ECD} = \frac{1}{2}(75^\circ) = 37.5^\circ$$


 (ii) Arc length $AB = \frac{60^\circ}{360^\circ} \times 2 \times \pi \times 12 = 12.56 \text{ cm}$.
3. (a) $\widehat{ACT} = 90^\circ$, $\therefore x^\circ = 90^\circ - 62^\circ = 28^\circ$
 (b) $y^\circ = 62^\circ$ ($\angle$ s in the same segment)
 (c) $BCDE$ is a cyclic quadrilateral,
 $z^\circ + 70^\circ + 62^\circ = 180^\circ \Rightarrow z^\circ = 48^\circ$
4. (a) $\widehat{CPR} = 40^\circ$ (same segment)
 (b) $BCQR$ is a cyclic quadrilateral,
 $\therefore \widehat{CQR} = 180^\circ - 40^\circ = 140^\circ$
 (c) $\widehat{ABC} = 90^\circ$, $\therefore \widehat{ABD} = 90^\circ - 40^\circ = 50^\circ$
 (d) $\widehat{BAD} = 90^\circ$, $\therefore \widehat{ADB} = 90^\circ - 50^\circ = 40^\circ$
5. (a) $\triangle ACD$ is a right angled $\triangle$,
 $\therefore \widehat{CDA} = 90^\circ - 33^\circ = 57^\circ$
 (b) $\widehat{DEC} = 33^\circ$ (same segment)
 (c) $ABCD$ is a cyclic quadrilateral,
 $\therefore \widehat{ABC} = 180^\circ - 57^\circ = 123^\circ$
 (d) $\widehat{AOE} = 2(70^\circ) = 140^\circ$ (same segment)
 $\therefore \text{reflex } \widehat{EOA} = 360^\circ - 140^\circ = 220^\circ$
6. (a) $x^\circ = 2 \times 34^\circ = 68^\circ$
 (b) $ABCD$ is a cyclic quadrilateral,
 $\therefore y^\circ = 180^\circ - 34^\circ = 146^\circ$
 (c) $z^\circ = 34^\circ$ ($\angle$ s in the same segment).
 (d) $\widehat{BAE} = 90^\circ$, $\therefore t^\circ = 90^\circ - 34^\circ = 56^\circ$
7. (a) $\widehat{PTQ} = 35^\circ$ because $\widehat{PSQ} = 35^\circ$.
 $\widehat{PTQ}$ and $\widehat{PSQ}$ are in the same segment.
 (b) $\widehat{QPT} = 90^\circ$, $\therefore \widehat{PQT} = 90^\circ - 35^\circ = 55^\circ$
 (c) In $\triangle PXT$, $\widehat{TPX} = 180^\circ - 35^\circ - 125^\circ = 20^\circ$
 $\therefore \widehat{SPQ} = 90^\circ - 20^\circ = 70^\circ$
 (d) $PQRS$ is a cyclic quadrilateral
 $\therefore \widehat{SRQ} = 180^\circ - 70^\circ = 110^\circ$
8. (a) $\widehat{BCA} = 90^\circ - 38^\circ = 52^\circ$
 (b) $\widehat{CBT} = 90^\circ$, $\widehat{ABT} = 90^\circ - 38^\circ = 52^\circ$
 $\triangle ABT$ is an isosceles $\triangle$,
 $\therefore \widehat{ATB} = 180^\circ - 2(52^\circ) = 76^\circ$
9. (a) $x^\circ = 2 \times 53^\circ = 106^\circ$
 (b) $ABCD$ is a cyclic quadrilateral,
 $y^\circ = 180^\circ - 53^\circ = 127^\circ$
 (c) ATB is an isosceles triangle.
 $z^\circ + z^\circ + 62^\circ = 180^\circ \Rightarrow z^\circ = 59^\circ$
 (d) $\angle OBT = 90^\circ$ (radius $\perp$ tangent)
 $\therefore t^\circ = 90^\circ - z^\circ = 31^\circ$.