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# Secondary School Certificate Examination

## March 2017

## Marking Scheme — Mathematics 30/1, 30/2, 30/3 [Outside Delhi]

***General Instructions:***

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage

2. Evaluation is to be done as per instructions provided in the marking scheme. It should not be done according to one's own interpretation or any other consideration — Marking Scheme should be strictly adhered to and religiously followed.

3. Alternative methods are accepted. Proportional marks are to be awarded.

4. If a candidate has attempted an extra question, marks obtained in the question attempted first should be retained and the other answer should be scored out.

5. A full scale of marks - 0 to 90 has to be used. Please do not hesitate to award full marks if the answer deserves it.

6. Separate Marking Scheme for all the three sets has been given.

7. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

QUESTION PAPER CODE 30/1

## EXPECTED ANSWER/VALUE POINTS

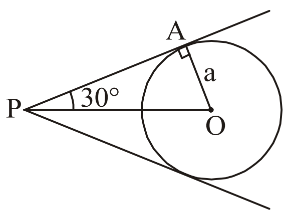
### SECTION A

**1.** $a_{21} - a_7 = 84 \Rightarrow (a + 20d) - (a + 6d) = 84$ $\frac{1}{2}$

$\Rightarrow \quad 14d = 84$

$\Rightarrow \quad d = 6$ $\frac{1}{2}$

**2.**

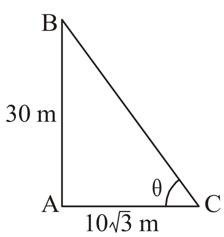



$\angle OPA = 30°$ $\frac{1}{2}$

$\sin 30° = \frac{a}{OP}$

$\Rightarrow \quad OP = 2a$ $\frac{1}{2}$

**3.**




$\tan \theta = \frac{30}{10\sqrt{3}} = \sqrt{3}$ $\frac{1}{2}$

$\Rightarrow \quad \theta = 60°$ $\frac{1}{2}$

**4.** Let the number of rotten apples in the heap be n.

$\therefore \quad \frac{n}{900} = 0.18$ $\frac{1}{2}$

$\Rightarrow \quad n = 162$ $\frac{1}{2}$

### SECTION B

**5.** Let the roots of the given equation be $\alpha$ and $6\alpha$. $\frac{1}{2}$

Thus the quadratic equation is $(x - \alpha)(x - 6\alpha) = 0$

$\Rightarrow x^2 - 7\alpha x + 6\alpha^2 = 0 \qquad ...(i)$ $\frac{1}{2}$

Given equation can be written as $x^2 - \frac{14}{p}x + \frac{8}{p} = 0 \qquad ...(ii)$ $\frac{1}{2}$

Comparing the co-efficients in (i) & (ii) $7\alpha = \frac{14}{p}$ and $6\alpha^2 = \frac{8}{p}$

Solving to get p = 3 $\frac{1}{2}$

**6.** Here $d = \frac{-3}{4}$ $\frac{1}{2}$

Let the nth term be first negative term

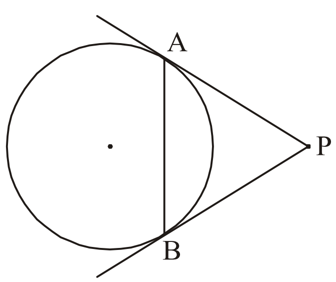
$\therefore \quad 20 + (n-1)\left(\frac{-3}{4}\right) < 0$ $\frac{1}{2}$

$\Rightarrow \quad 3n > 83$

$\Rightarrow \quad n > 27\frac{2}{3}$ $\frac{1}{2}$

Hence $28^{th}$ term is first negative term. $\frac{1}{2}$

**7.**




**Case I:**

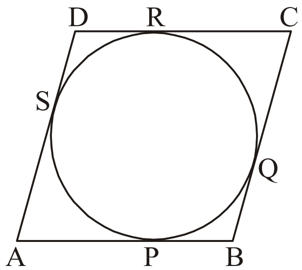
Correct Figure $\frac{1}{2}$

Since PA = PB

Therefore in $\Delta PAB$ $\frac{1}{2}$

$\angle PAB = \angle PBA$ $\frac{1}{2}$

**Case II:** If the tangents at A and B are parallel then each angle between chord and tangent = 90° $\frac{1}{2}$

**8.** 


Here $AP = AS$

$BP = BQ$ 1

$CR = CQ$

$DR = DS$

Adding $(AP + PB) + (CR + RD) = (AS + SD) + (BQ + QC)$ $\frac{1}{2}$

$\Rightarrow \quad AB + CD = AD + BC$ $\frac{1}{2}$

**9.** Let the coordinates of points P and Q be (0, b) and (a, 0) resp. $\frac{1}{2}$

$\therefore \quad \frac{a}{2} = 2 \Rightarrow a = 4$ $\frac{1}{2}$

$\frac{b}{2} = -5 \Rightarrow b = -10$ $\frac{1}{2}$

$\therefore \quad P(0, -10)$ and $Q(4, 0)$ $\frac{1}{2}$

**10.** $PA^2 = PB^2$

$\Rightarrow \quad (x-5)^2 + (y-1)^2 = (x+1)^2 + (y-5)^2$ 1

$\Rightarrow \quad 12x = 8y$

$\Rightarrow \quad 3x = 2y$ 1

**SECTION C**

**11.** $D = 4(ac + bd)^2 - 4(a^2 + b^2)(c^2 + d^2)$ 1

$= -4(a^2d^2 + b^2c^2 - 2abcd)$

$= -4(ad - bc)^2$ 1

Since $ad \neq bc$

Therefore $D < 0$ $\frac{1}{2}$

The equation has no real roots $\frac{1}{2}$

**12.** Here a = 5, $l$ = 45 and $S_n$ = 400

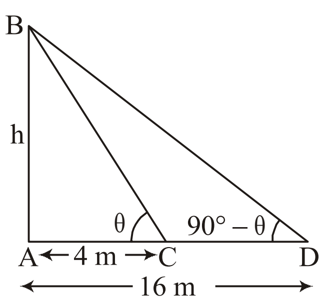
$\therefore\ \frac{n}{2}(a+l) = 400$ or $\frac{n}{2}(5+45) = 400$ 1

$\Rightarrow\quad n = 16$ $\frac{1}{2}$

Also 5 + 15d = 45 1

$\Rightarrow\quad d = \frac{8}{3}$ $\frac{1}{2}$

**13.**




Correct Figure $\frac{1}{2}$

$\tan\theta = \frac{h}{4}$ ...(i) $\frac{1}{2}$

$\tan(90-\theta) = \frac{h}{16}$

$\Rightarrow\quad \cot\theta = \frac{h}{16}$ ...(ii) 1

Solving (i) and (ii) to get

$h^2 = 64$

$\Rightarrow\quad h = 8m$ 1

**14.** Let the number of black balls in the bag be n.

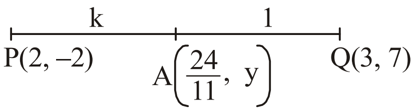
$\therefore$ Total number of balls are 15 + n 1

Prob(Black ball) = 3 × Prob(White ball)

$\Rightarrow\quad \frac{n}{15+n} = 3\times\frac{15}{15+n}$ 1

$\Rightarrow\quad n = 45$ 1

**15.**




Let PA: AQ = k : 1

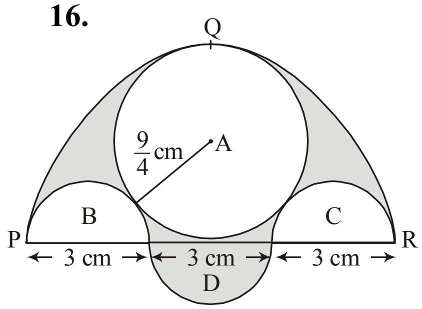
$\therefore \quad \frac{2+3k}{k+1} = \frac{24}{11}$ 1

$\Rightarrow \quad k = \frac{2}{9}$ $\frac{1}{2}$

Hence the ratio is 2 : 9. $\frac{1}{2}$

Therefore $y = \frac{-18+14}{11} = \frac{-4}{11}$ 1

**16.**




Area of semi-circle PQR $= \frac{\pi}{2}\left(\frac{9}{2}\right)^2 = \frac{81}{8}\pi \text{ cm}^2$ $\frac{1}{2}$

Area of region A $= \pi\left(\frac{9}{4}\right)^2 = \frac{81}{16}\pi \text{ cm}^2$ $\frac{1}{2}$

Area of region (B + C) $= \pi\left(\frac{3}{2}\right)^2 = \frac{9}{4}\pi \text{ cm}^2$ $\frac{1}{2}$

Area of region D $= \frac{\pi}{2}\left(\frac{3}{2}\right)^2 = \frac{9}{8}\pi \text{ cm}^2$ $\frac{1}{2}$

Area of shaded region $= \left(\frac{81}{8}\pi - \frac{81}{16}\pi - \frac{9}{4}\pi + \frac{9}{8}\pi\right) \text{cm}^2$

$= \frac{63}{16}\pi \text{ cm}^2 \text{ or } \frac{99}{8} \text{cm}^2$ 1

**17.** Area of region ABDC $= \pi\frac{60}{360} \times (42^2 - 21^2)$

$= \frac{22}{7} \times \frac{1}{6} \times 63 \times 21$

$= 693 \text{ cm}^2$ 1

Area of shaded region $= \pi(42^2 - 21^2) - \text{region ABDC}$

$= \frac{22}{7} \times 63 \times 21 - 693$ 1

$= 4158 - 693$

$= 3465 \text{ cm}^2$ 1

**18.** Volume of water flowing in 40 min $= 5.4 \times 1.8 \times 25000 \times \frac{40}{60} \text{ m}^3$ 1

$= 162000 \text{ m}^3$ $\frac{1}{2}$

Height of standing water = 10 cm = 0.10 m

$\therefore$ Area to be irrigated $= \frac{162000}{0.10}$ 1

$= 1620000 \text{ m}^2$ $\frac{1}{2}$

**19.** Here $l = 4$ cm, $2\pi r_1 = 18$ cm and $2\pi r_2 = 6$ cm

$\Rightarrow \quad \pi r_1 = 9, \ \pi r_2 = 3$ 1

Curved surface area of frustum $= \pi(r_1 + r_2) \times l$ or $(\pi r_1 + \pi r_2) \times l$ 1

$= (9 + 3) \times 4$ $\frac{1}{2}$

$= 48 \text{ cm}^2$ $\frac{1}{2}$

**20.** Volume of cuboid $= 4.4 \times 2.6 \times 1 \text{ m}^3$ $\frac{1}{2}$

Inner and outer radii of cylindrical pipe = 30 cm, 35 cm $\frac{1}{2}$

$\therefore$ Volume of material used $= \frac{\pi}{100^2}(35^2 - 30^2) \times h \text{ m}^3$

$= \frac{\pi}{100^2} \times 65 \times 5h$ $\frac{1}{2}$

Now $\frac{\pi}{100^2} \times 65 \times 5h = 4.4 \times 2.6$

$\Rightarrow \quad h = \frac{7 \times 4.4 \times 2.6 \times 100 \times 100}{22 \times 65 \times 5}$ $\frac{1}{2}+\frac{1}{2}$

$\Rightarrow \quad h = 112$ m $\frac{1}{2}$

## SECTION D

**21.** Here $[(5x+1)+(x+1)3](x+4) = 5(x+1)(5x+1)$ 1

$\Rightarrow \quad (8x+4)(x+4) = 5(5x^2+6x+1)$

$\Rightarrow \quad 17x^2 - 6x - 11 = 0$ 1

$\Rightarrow \quad (17x+11)(x-1) = 0$ 1

$\Rightarrow \quad x = \frac{-11}{17}, x = 1$ 1

**22.** Let one tap fill the tank in x hrs.

Therefore, other tap fills the tank in $(x+3)$ hrs. $\frac{1}{2}$

Work done by both the taps in one hour is

$\frac{1}{x} + \frac{1}{x+3} = \frac{13}{40}$ 1

$\Rightarrow \quad (2x+3)\,40 = 13(x^2+3x)$

$\Rightarrow \quad 13x^2 - 41x - 120 = 0$ 1

$\Rightarrow (13x+24)(x-5) = 0$

$\Rightarrow \quad x = 5$ 1

(rejecting the negative value)

Hence one tap takes 5 hrs and another 8 hrs separately to fill the tank. $\frac{1}{2}$

**23.** Let the first terms be a and a′ and d and d′ be their respective common differences.

$$\frac{S_n}{S'_n} = \frac{\frac{n}{2}(2a+(n-1)d)}{\frac{n}{2}(2a'+(n-1)d')} = \frac{7n+1}{4n+27} \qquad 1$$

$$\Rightarrow \quad \frac{a+\left(\frac{n-1}{2}\right)d}{a'+\left(\frac{n-1}{2}\right)d'} = \frac{7n+1}{4n+27} \qquad 1$$

To get ratio of $9^{th}$ terms, replacing $\frac{n-1}{2} = 8$

$\Rightarrow \quad n = 17$ 1

Hence $\frac{t_9}{t'_9} = \frac{a+8d}{a'+8d'} = \frac{120}{95}$ or $\frac{24}{19}$ 1

**24.** Correct given, to prove, construction and figure $4\times\frac{1}{2}=2$

Correct Proof 2

**25.** In right angled $\Delta POA$ and $\Delta OCA$

$\Delta OPA \cong \Delta OCA$

$\therefore \quad \angle POA = \angle AOC \quad$ ...(i) 1

Also $\Delta OQB \cong \Delta OCB$

$\therefore \quad \angle QOB = \angle BOC \quad$ ...(ii) 1

Therefore $\angle AOB = \angle AOC + \angle COB$

$= \frac{1}{2}\angle POC + \frac{1}{2}\angle COQ$ 1

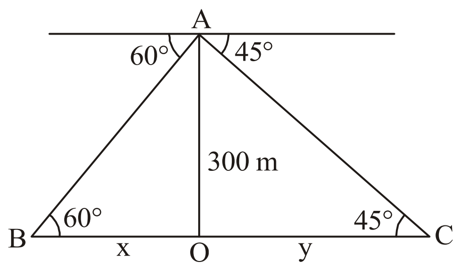
$= \frac{1}{2}(\angle POC + \angle COQ)$

$= \frac{1}{2}\times 180°$

$= 90°$ 1

**26.** Correct construction of $\Delta ABC$ and corresponding similar triangle 2+2

**27.** Correct Figure 1




$\tan 45° = \frac{300}{y}$

$\Rightarrow \quad 1 = \frac{300}{y}$ or $y = 300$ 1

$\tan 60° = \frac{300}{x}$

$\Rightarrow \quad \sqrt{3} = \frac{300}{x}$ or $x = \frac{300}{\sqrt{3}} = 100\sqrt{3}$ 1

Width of river = $300 + 100\sqrt{3} = 300 + 173.2$

= 473.2 m 1

**28.** Points A, B and C are collinear

Therefore $\frac{1}{2}[(k+1)(2k+3-5k)+3k(5k-2k)+(5k-1)(2k-2k-3)] = 0$ 1

$= (k+1)(3-3k) + 9k^2 - 3(5k-1) = 0$

$= 2k^2 - 5k + 2 = 0$ 2

$= (k-2)(2k-1) = 0$

$\Rightarrow \quad k = 2, \frac{1}{2}$ 1

**29.** Total number of outcomes = 36 1

(i) P(even sum) = $\frac{18}{36} = \frac{1}{2}$ $1\frac{1}{2}$

(ii) P(even product) = $\frac{27}{36} = \frac{3}{4}$ $1\frac{1}{2}$

**30.** Area of shaded region $= (21 \times 14) - \frac{1}{2} \times \pi \times 7 \times 7$ 1

$= 294 - \frac{1}{2} \times \frac{22}{7} \times 7 \times 7$

$= 294 - 77$

$= 217 \text{ cm}^2$. 1

Perimeter of shaded region $= 21 + 14 + 21 + \frac{22}{7} \times 7$ 1

$= 56 + 22$

$= 78$ cm 1

**31.** Volume of rain water on the roof = Volume of cylindrical tank $\frac{1}{2}$

i.e., $22 \times 20 \times h = \frac{22}{7} \times 1 \times 1 \times 3.5$ 1

$\Rightarrow \quad h = \frac{1}{40}$ m 1

$= 2.5$ cm $\frac{1}{2}$

Water conservation must be encouraged

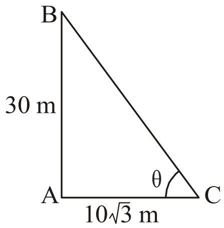
or views relevant to it. 1

# QUESTION PAPER CODE 30/2

## EXPECTED ANSWER/VALUE POINTS

### SECTION A

**1.**




$\tan\theta = \dfrac{30}{10\sqrt{3}} = \sqrt{3}$ $\quad \frac{1}{2}$

$\Rightarrow \theta = 60°$ $\quad \frac{1}{2}$

**2.** Let the number of rotten apples in the heap be n.

$\therefore \quad \dfrac{n}{900} = 0.18$ $\quad \frac{1}{2}$

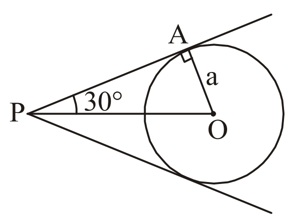
$\Rightarrow \quad n = 162$ $\quad \frac{1}{2}$

**3.** $a_{21} - a_7 = 84 \Rightarrow (a + 20d) - (a + 6d) = 84$ $\quad \frac{1}{2}$

$\Rightarrow \quad 14d = 84$

$\Rightarrow \quad d = 6$ $\quad \frac{1}{2}$

**4.**




$\angle OPA = 30°$ $\quad \frac{1}{2}$

$\sin 30° = \dfrac{a}{OP}$

$\Rightarrow \quad OP = 2a$ $\quad \frac{1}{2}$

### SECTION B

**5.** Let the coordinates of points P and Q be (0, b) and (a, 0) resp. $\quad \frac{1}{2}$

$\therefore \quad \dfrac{a}{2} = 2 \Rightarrow a = 4$ $\quad \frac{1}{2}$

$\frac{b}{2} = -5 \Rightarrow b = -10$ $\frac{1}{2}$

$\therefore$ P(0, –10) and Q(4, 0) $\frac{1}{2}$

6. $PA^2 = PB^2$

$\Rightarrow (x-5)^2 + (y-1)^2 = (x+1)^2 + (y-5)^2$ 1

$\Rightarrow 12x = 8y$

$\Rightarrow 3x = 2y$ 1

7. Let the roots of the given equation be $\alpha$ and $6\alpha$. $\frac{1}{2}$

Thus the quadratic equation is $(x-\alpha)(x-6\alpha) = 0$

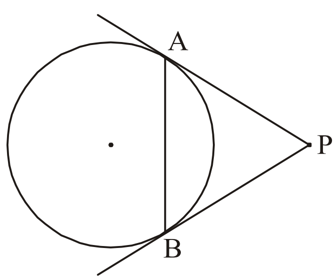
$\Rightarrow x^2 - 7\alpha x + 6\alpha^2 = 0$ ...(i) $\frac{1}{2}$

Given equation can be written as $x^2 - \frac{14}{p}x + \frac{8}{p} = 0$ ...(ii) $\frac{1}{2}$

Comparing the co-efficients in (i) & (ii) $7\alpha = \frac{14}{p}$ and $6\alpha^2 = \frac{8}{p}$

Solving to get $p = 3$ $\frac{1}{2}$

8.




**Case I:**

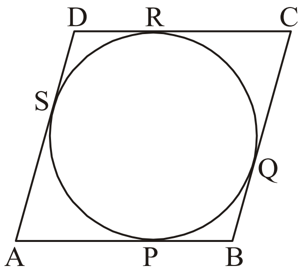
Correct Figure $\frac{1}{2}$

Since PA = PB

Therefore in $\Delta PAB$ $\frac{1}{2}$

$\angle PAB = \angle PBA$ $\frac{1}{2}$

**Case II:** If the tangents at A and B are parallel then each angle between chord and tangent = 90° $\frac{1}{2}$

**9.** 


Here $AP = AS$

$BP = BQ$ 1

$CR = CQ$

$DR = DS$

Adding $(AP + PB) + (CR + RD) = (AS + SD) + (BQ + QC)$ $\frac{1}{2}$

$\Rightarrow \quad AB + CD = AD + BC$ $\frac{1}{2}$

**10.** Here $a = 8$, $d = 6$

Let $a_n = 72 + a_{41}$

$\Rightarrow \quad 8 + (n-1)6 = 72 + 8 + 40 \times 6$ 1

$\Rightarrow \quad 6n = 318$

$\Rightarrow \quad n = 53.$ 1

## SECTION C

**11.** Volume of cuboid $= 4.4 \times 2.6 \times 1 \text{ m}^3$ $\frac{1}{2}$

Inner and outer radii of cylindrical pipe = 30 cm, 35 cm $\frac{1}{2}$

$\therefore \quad$ Volume of material used $= \frac{\pi}{100^2}(35^2 - 30^2) \times h \text{ m}^3$

$= \frac{\pi}{100^2} \times 65 \times 5h$ $\frac{1}{2}$

Now $\frac{\pi}{100^2} \times 65 \times 5h = 4.4 \times 2.6$

$\Rightarrow \quad h = \frac{7 \times 4.4 \times 2.6 \times 100 \times 100}{22 \times 65 \times 5}$ $\frac{1}{2} + \frac{1}{2}$

$\Rightarrow \quad h = 112 \text{ m}$ $\frac{1}{2}$

**12.** Area of region ABDC $= \pi \frac{60}{360} \times (42^2 - 21^2)$

$= \frac{22}{7} \times \frac{1}{6} \times 63 \times 21$

$= 693 \text{ cm}^2$ 1

Area of shaded region $= \pi(42^2 - 21^2) -$ region ABDC

$= \frac{22}{7} \times 63 \times 21 - 693$ 1

$= 4158 - 693$

$= 3465 \text{ cm}^2$ 1

**13.** Volume of water flowing in 40 min $= 5.4 \times 1.8 \times 25000 \times \frac{40}{60} \text{ m}^3$ 1

$= 162000 \text{ m}^3$ $\frac{1}{2}$

Height of standing water = 10 cm = 0.10 m

$\therefore$ Area to be irrigated $= \frac{162000}{0.10}$ 1

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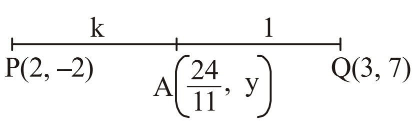
**14.**




Let PA: AQ = k : 1

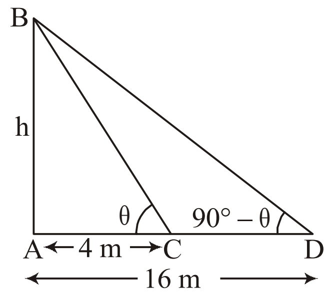
$\therefore \quad \frac{2+3k}{k+1} = \frac{24}{11}$ 1

$\Rightarrow \quad k = \frac{2}{9}$ $\frac{1}{2}$

Hence the ratio is 2 : 9. $\frac{1}{2}$

Therefore $y = \frac{-18+14}{11} = \frac{-4}{11}$ 1

**15.**




Correct Figure $\frac{1}{2}$

$\tan\theta = \frac{h}{4}$ ...(i) $\frac{1}{2}$

$\tan(90-\theta) = \frac{h}{16}$

$\Rightarrow \quad \cot\theta = \frac{h}{16}$ ...(ii) 1

Solving (i) and (ii) to get

$h^2 = 64$

$\Rightarrow \quad h = 8m$ 1

**16.** Let the number of black balls in the bag be n.

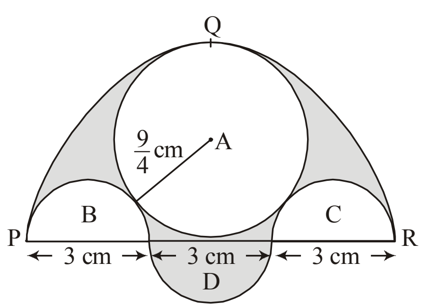
$\therefore$ Total number of balls are $15 + n$ 1

Prob(Black ball) = 3 × Prob(White ball)

$\Rightarrow \quad \frac{n}{15+n} = 3 \times \frac{15}{15+n}$ 1

$\Rightarrow \quad n = 45$ 1

**17.**




Area of semi-circle PQR $= \frac{\pi}{2}\left(\frac{9}{2}\right)^2 = \frac{81}{8}\pi\ cm^2$ $\frac{1}{2}$

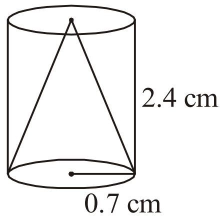
Area of region A $= \pi\left(\frac{9}{4}\right)^2 = \frac{81}{16}\pi\ cm^2$ $\frac{1}{2}$

Area of region (B + C) $= \pi\left(\frac{3}{2}\right)^2 = \frac{9}{4}\pi\ cm^2$ $\frac{1}{2}$

Area of region D $= \frac{\pi}{2}\left(\frac{3}{2}\right)^2 = \frac{9}{8}\pi\ cm^2$ $\frac{1}{2}$

Area of shaded region $= \left(\frac{81}{8}\pi - \frac{81}{16}\pi - \frac{9}{4}\pi + \frac{9}{8}\pi\right) cm^2$

$= \frac{63}{16}\pi\ cm^2$ or $\frac{99}{8} cm^2$ 1

**18.** 

Total surface area of remaining soild

$= \pi r l + \pi r^2 + 2\pi r h$ 1

$l = \sqrt{(2.4)^2 + (0.7)^2} = 2.5$ cm $\frac{1}{2}$

$\therefore$ TSA $= \pi r(l + r + 2h)$

$= \frac{22}{7} \times 0.7(2.5 + 0.7 + 4.8)$

$= 17.6$ cm$^2$ $1\frac{1}{2}$

**19.** Here $a_{10} = 52$

$\Rightarrow \quad a + 9d = 52 \quad \ldots(i)$ 1

Also $a_{17} = 20 + a_{13}$

$\Rightarrow \quad a + 16d = 20 + a + 12d$

$\Rightarrow \quad 4d = 20 \quad \ldots(ii)$ 1

Solving to get d = 5 and a = 7 $\frac{1}{2} + \frac{1}{2}$

or A.P. is 7, 12, 17, 22, ......

**20.** For equal roots D = 0

Therefore $4(a^2 - bc)^2 - 4(c^2 - ab)(b^2 - ac) = 0$ 1

$4[a^4 + b^2c^2 - 2a^2bc - b^2c^2 + ac^3 + ab^3 - a^2bc] = 0$ 1

$\Rightarrow \quad a(a^3 + b^3 + c^3 - 3abc) = 0$ $\frac{1}{2}$

$\Rightarrow \quad a = 0$ or $a^3 + b^3 + c^3 = 3abc$ $\frac{1}{2}$

## SECTION D

**21.** Points A, B and C are collinear

Therefore $\frac{1}{2}[(k+1)(2k+3-5k)+3k(5k-2k)+(5k-1)(2k-2k-3)]=0$ 1

$= (k + 1)(3 - 3k) + 9k^2 - 3(5k - 1) = 0$

$= 2k^2 - 5k + 2 = 0$ 2

$= (k - 2)(2k - 1) = 0$

$\Rightarrow \quad k = 2, \frac{1}{2}$ 1

**22.** Total number of outcomes = 36 1

(i) P(even sum) = $\frac{18}{36} = \frac{1}{2}$ $1\frac{1}{2}$

(ii) P(even product) = $\frac{27}{36} = \frac{3}{4}$ $1\frac{1}{2}$

**23.** Correct construction of $\Delta$ABC and corresponding similar triangle 2+2

**24.** Volume of rain water on the roof = Volume of cylindrical tank $\frac{1}{2}$

i.e., $22 \times 20 \times h = \frac{22}{7} \times 1 \times 1 \times 3.5$ 1

$\Rightarrow \quad h = \frac{1}{40}$ m 1

$= 2.5$ cm $\frac{1}{2}$

Water conservation must be encouraged

or views relevant to it. 1

**25.** Correct given, to prove, construction and figure $4 \times \frac{1}{2} = 2$

Correct Proof 2

**26.** In right angled $\Delta POA$ and $\Delta OCA$

$\Delta OPA \cong \Delta OCA$

$\therefore \quad \angle POA = \angle AOC \quad ...(i)$ 1

Also $\Delta OQB \cong \Delta OCB$

$\therefore \quad \angle QOB = \angle BOC \quad ...(ii)$ 1

Therefore $\angle AOB = \angle AOC + \angle COB$

$= \frac{1}{2}\angle POC + \frac{1}{2}\angle COQ$ 1

$= \frac{1}{2}(\angle POC + \angle COQ)$

$= \frac{1}{2} \times 180°$

$= 90°$ 1

**27.** Let the first terms be a and a′ and d and d′ be their respective common differences.

$$\frac{S_n}{S'_n} = \frac{\frac{n}{2}(2a + (n-1)d)}{\frac{n}{2}(2a' + (n-1)d')} = \frac{7n+1}{4n+27}$$ 1

$$\Rightarrow \quad \frac{a + \left(\frac{n-1}{2}\right)d}{a' + \left(\frac{n-1}{2}\right)d'} = \frac{7n+1}{4n+27}$$ 1

To get ratio of $9^{th}$ terms, replacing $\frac{n-1}{2} = 8$

$\Rightarrow \quad n = 17$ 1

Hence $\frac{t_9}{t'_9} = \frac{a+8d}{a'+8d'} = \frac{120}{95}$ or $\frac{24}{19}$ 1

**28.** $[(x-5) + (2x+3)]9 = 10(2x-3)(x-5)$ 1

$\Rightarrow \quad 20x^2 - 157x + 222 = 0$ 1

$\Rightarrow \quad (x-6)(20x-37)=0$ 1

$\Rightarrow \quad x = 6, \dfrac{37}{20}$ 1

**29.** Let original speed of train be x km/hr

Therefore $\dfrac{300}{x} - \dfrac{300}{x+5} = 2$ $1\frac{1}{2}$

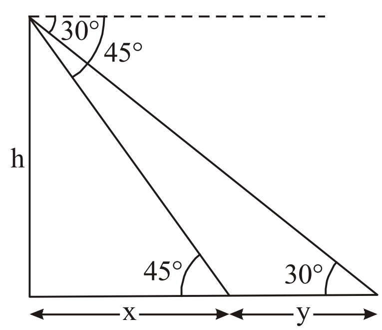
$\Rightarrow \quad x^2 + 5x - 750 = 0$ 1

$\Rightarrow \quad (x+30)(x-25)=0$

$\Rightarrow \quad x = 25 \text{ or } x = -30$ 1

$\therefore \quad$ Speed = 25 km/hr $\frac{1}{2}$

**30.**




Correct Figure 1

$\dfrac{h}{x} = \tan 45° = 1$

$\Rightarrow \quad h = x \quad ...(i)$ $\frac{1}{2}$

$\dfrac{h}{x+y} = \tan 30° = \dfrac{1}{\sqrt{3}}$

$\Rightarrow \quad \sqrt{3}h = x + y \quad ...(ii)$ $\frac{1}{2}$

Therefore from (i) & (ii) $\sqrt{3}x = x + y$

$\Rightarrow \quad y = x(\sqrt{3}-1)$ 1

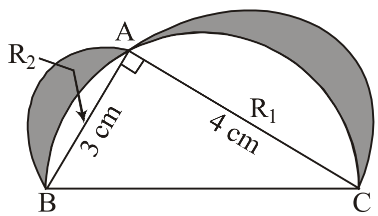
To cover a distance of $x(\sqrt{3}-1)$, car takes 12 min.

$\therefore$ Time taken by car to cover a distance of x units $= \dfrac{12}{\sqrt{3}-1}$ minutes

$= \quad 6(\sqrt{3}+1)$ min 1

or $\quad$ 16.4 min (approx).

31.




$$BC = \sqrt{3^2 + 4^2} = 5 \text{ cm}$$ $\frac{1}{2}$

$$\text{Area } (R_1 + R_2) = \frac{\pi}{2}\left(\frac{5}{2}\right)^2 - \frac{1}{2} \times 3 \times 4 \text{ cm}^2$$

$$= \left(\frac{25}{8}\pi - 6\right) \text{cm}^2 \qquad \text{...(i)}$$ 1

$$\text{Area of shaded region} = \frac{\pi}{2}\left(\frac{3}{2}\right)^2 + \frac{\pi}{2}(2)^2 - \left[\frac{25}{8}\pi - 6\right] \text{cm}^2$$ 1

$$= \frac{\pi}{2}\left(\frac{9}{4} + 4 - \frac{25}{4}\right) + 6$$ 1

$$= 6 \text{ cm}^2$$ $\frac{1}{2}$

# QUESTION PAPER CODE 30/3

## EXPECTED ANSWER/VALUE POINTS

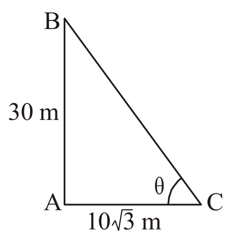
### SECTION A

**1.** Let the number of rotten apples in the heap be n.

$\therefore \quad \frac{n}{900} = 0.18$ $\frac{1}{2}$

$\Rightarrow \quad n = 162$ $\frac{1}{2}$

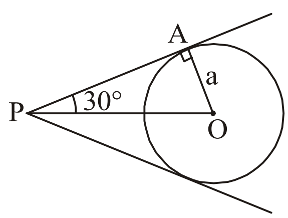
**2.**




$\tan\theta = \frac{30}{10\sqrt{3}} = \sqrt{3}$ $\frac{1}{2}$

$\Rightarrow \quad \theta = 60°$ $\frac{1}{2}$

**3.**




$\angle OPA = 30°$ $\frac{1}{2}$

$\sin 30° = \frac{a}{OP}$

$\Rightarrow \quad OP = 2a$ $\frac{1}{2}$

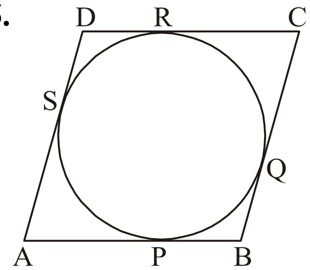
**4.** $a_{21} - a_7 = 84 \Rightarrow (a + 20d) - (a + 6d) = 84$ $\frac{1}{2}$

$\Rightarrow \quad 14d = 84$

$\Rightarrow \quad d = 6$ $\frac{1}{2}$

## SECTION B

**5.**




Here AP = AS

BP = BQ 1

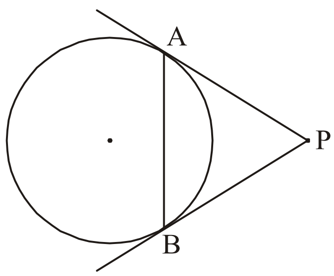
CR = CQ

DR = DS

Adding (AP + PB) + (CR + RD) = (AS + SD) + (BQ + QC) $\frac{1}{2}$

$\Rightarrow$ AB + CD = AD + BC $\frac{1}{2}$

**6.**




**Case I:**

Correct Figure $\frac{1}{2}$

Since PA = PB

Therefore in $\Delta$PAB $\frac{1}{2}$

$\angle PAB = \angle PBA$ $\frac{1}{2}$

**Case II:** If the tangents at A and B are parallel then each angle between chord and tangent = 90° $\frac{1}{2}$

**7.** Let the coordinates of points P and Q be (0, b) and (a, 0) resp. $\frac{1}{2}$

$\therefore \quad \frac{a}{2} = 2 \Rightarrow a = 4$ $\frac{1}{2}$

$\frac{b}{2} = -5 \Rightarrow b = -10$ $\frac{1}{2}$

$\therefore$ P(0, –10) and Q(4, 0) $\frac{1}{2}$

**8.** $PA^2 = PB^2$

$\Rightarrow \quad (x-5)^2 + (y-1)^2 = (x+1)^2 + (y-5)^2$ 1

$\Rightarrow \quad 12x = 8y$

$\Rightarrow \quad 3x = 2y$ 1

**9.** Let the roots of the given equation be $\alpha$ and $6\alpha$. $\frac{1}{2}$

Thus the quadratic equation is $(x-\alpha)(x-6\alpha)=0$

$\Rightarrow x^2 - 7\alpha x + 6\alpha^2 = 0 \quad ...(i)$ $\frac{1}{2}$

Given equation can be written as $x^2 - \frac{14}{p}x + \frac{8}{p} = 0 \quad ...(ii)$ $\frac{1}{2}$

Comparing the co-efficients in (i) & (ii) $7\alpha = \frac{14}{p}$ and $6\alpha^2 = \frac{8}{p}$

Solving to get $p = 3$ $\frac{1}{2}$

**10.** Here $a_n = a'_n$

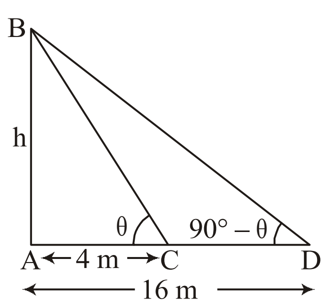
$\Rightarrow \quad 63 + (n-1)2 = 3 + (n-1)7$ 1

$\Rightarrow \quad 5n = 65$

$\Rightarrow \quad n = 13.$ 1

**SECTION C**

**11.**




Correct Figure $\frac{1}{2}$

$\tan\theta = \frac{h}{4} \quad ...(i)$ $\frac{1}{2}$

$\tan(90-\theta) = \frac{h}{16}$

$\Rightarrow \quad \cot\theta = \frac{h}{16} \quad ...(ii)$ 1

Solving (i) and (ii) to get

$h^2 = 64$

$\Rightarrow \quad h = 8m$ 1

**12.** Let the number of black balls in the bag be n.

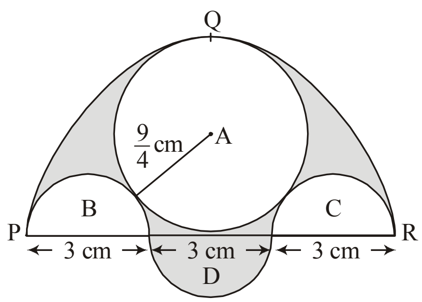
$\therefore$ Total number of balls are $15 + n$ 1

Prob(Black ball) = 3 × Prob(White ball)

$\Rightarrow \quad \dfrac{n}{15+n} = 3 \times \dfrac{15}{15+n}$ 1

$\Rightarrow \quad n = 45$ 1

**13.**




Area of semi-circle PQR $= \dfrac{\pi}{2}\left(\dfrac{9}{2}\right)^2 = \dfrac{81}{8}\pi\ \text{cm}^2$ $\dfrac{1}{2}$

Area of region A $= \pi\left(\dfrac{9}{4}\right)^2 = \dfrac{81}{16}\pi\ \text{cm}^2$ $\dfrac{1}{2}$

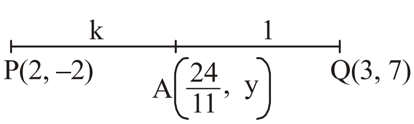
Area of region (B + C) $= \pi\left(\dfrac{3}{2}\right)^2 = \dfrac{9}{4}\pi\ \text{cm}^2$ $\dfrac{1}{2}$

Area of region D $= \dfrac{\pi}{2}\left(\dfrac{3}{2}\right)^2 = \dfrac{9}{8}\pi\ \text{cm}^2$ $\dfrac{1}{2}$

Area of shaded region $= \left(\dfrac{81}{8}\pi - \dfrac{81}{16}\pi - \dfrac{9}{4}\pi + \dfrac{9}{8}\pi\right)\text{cm}^2$

$= \dfrac{63}{16}\pi\ \text{cm}^2$ or $\dfrac{99}{8}\ \text{cm}^2$ 1

**14.**




Let PA: AQ = k : 1

$\therefore \quad \dfrac{2+3k}{k+1} = \dfrac{24}{11}$ 1

$\Rightarrow \quad k = \dfrac{2}{9}$ $\dfrac{1}{2}$

Hence the ratio is 2 : 9. $\dfrac{1}{2}$

Therefore $y = \dfrac{-18+14}{11} = \dfrac{-4}{11}$ 1

**15.** Volume of water flowing in 40 min = $5.4 \times 1.8 \times 25000 \times \frac{40}{60}$ m$^3$ 1

= 162000 m$^3$ $\frac{1}{2}$

Height of standing water = 10 cm = 0.10 m

$\therefore$ Area to be irrigated = $\frac{162000}{0.10}$ 1

= 1620000 m$^2$ $\frac{1}{2}$

**16.** Area of region ABDC = $\pi \frac{60}{360} \times (42^2 - 21^2)$

$= \frac{22}{7} \times \frac{1}{6} \times 63 \times 21$

= 693 cm$^2$ 1

Area of shaded region = $\pi(42^2 - 21^2)$ – region ABDC

$= \frac{22}{7} \times 63 \times 21 - 693$ 1

= 4158 – 693

= 3465 cm$^2$ 1

**17.** Volume of cuboid = 4.4 × 2.6 × 1 m$^3$ $\frac{1}{2}$

Inner and outer radii of cylindrical pipe = 30 cm, 35 cm $\frac{1}{2}$

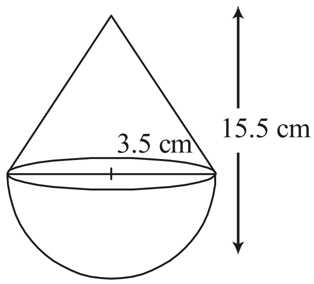
$\therefore$ Volume of material used = $\frac{\pi}{100^2}(35^2 - 30^2) \times h$ m$^3$

$= \frac{\pi}{100^2} \times 65 \times 5h$ $\frac{1}{2}$

Now $\frac{\pi}{100^2} \times 65 \times 5h = 4.4 \times 2.6$

$\Rightarrow \quad h = \dfrac{7 \times 4.4 \times 2.6 \times 100 \times 100}{22 \times 65 \times 5}$ $\dfrac{1}{2} + \dfrac{1}{2}$

$\Rightarrow \quad h = 112$ m $\dfrac{1}{2}$

**18.** 


Height of cone = 15.5 – 3.5 = 12 cm $\dfrac{1}{2}$

$\therefore \quad l = \sqrt{(3.5)^2 + 12^2} = 12.5$ cm 1

Total surface area = $\pi rl + 2\pi r^2$

$= \dfrac{22}{7} \times 3.5\,(12.5 + 7)$ 1

$= 214.5$ cm$^2$ $\dfrac{1}{2}$

**19.** Here a = 9, d = 8, Sn = 636

Therefore $636 = \dfrac{n}{2}[18 + (n - 1)8]$ 1

$\Rightarrow \quad 4n^2 + 5n - 636 = 0$ 1

$\Rightarrow \quad (4n + 53)(n - 12) = 0$

$n = 12$ 1

**20.** For equal roots D = 0

$\Rightarrow \quad 4(ac + bd)^2 - 4(a^2 + b^2)(c^2 + d^2) = 0$ 1

$\Rightarrow \quad 4(a^2c^2 + b^2d^2 + 2abcd - a^2c^2 - a^2d^2 - b^2c^2 - b^2d^2) = 0$

$\Rightarrow \quad -4(a^2d^2 + b^2c^2 - 2abcd) = 0$ 1

$\Rightarrow \quad (ad - bc)^2 = 0$ $\dfrac{1}{2}$

$\Rightarrow \quad ad = bc$

$\Rightarrow \quad \dfrac{a}{b} = \dfrac{c}{d}$ $\dfrac{1}{2}$

## SECTION D

**21.** Points A, B and C are collinear

Therefore $\frac{1}{2}[(k+1)(2k+3-5k)+3k(5k-2k)+(5k-1)(2k-2k-3)]=0$ 1

$= (k + 1)(3 - 3k) + 9k^2 - 3(5k - 1) = 0$

$= 2k^2 - 5k + 2 = 0$ 2

$= (k - 2)\ (2k - 1) = 0$

$\Rightarrow \quad k = 2, \frac{1}{2}$ 1

**22.** Correct construction of $\Delta ABC$ and corresponding similar triangle 2+2

**23.** Total number of outcomes = 36 1

(i) P(even sum) = $\frac{18}{36} = \frac{1}{2}$ $1\frac{1}{2}$

(ii) P(even product) = $\frac{27}{36} = \frac{3}{4}$ $1\frac{1}{2}$

**24.** In right angled $\Delta POA$ and $\Delta OCA$

$\Delta OPA \cong \Delta OCA$

$\therefore \quad \angle POA = \angle AOC \quad$ ...(i) 1

Also $\Delta OQB \cong \Delta OCB$

$\therefore \quad \angle QOB = \angle BOC \quad$ ...(ii) 1

Therefore $\angle AOB = \angle AOC + \angle COB$

$= \frac{1}{2}\angle POC + \frac{1}{2}\angle COQ$ 1

$= \frac{1}{2}(\angle POC + \angle COQ)$

$= \frac{1}{2} \times 180°$

$= 90°$ 1

**25.** Volume of rain water on the roof = Volume of cylindrical tank $\frac{1}{2}$

i.e., $22 \times 20 \times h = \frac{22}{7} \times 1 \times 1 \times 3.5$ 1

$\Rightarrow \quad h = \frac{1}{40}\,m$ 1

$= 2.5$ cm $\frac{1}{2}$

Water conservation must be encouraged

or views relevant to it. 1

**26.** Correct given, to prove, construction and figure $4 \times \frac{1}{2} = 2$

Correct Proof 2

**27.** Let the first terms be a and a′ and d and d′ be their respective common differences.

$$\frac{S_n}{S_n'} = \frac{\frac{n}{2}(2a + (n-1)d)}{\frac{n}{2}(2a' + (n-1)d')} = \frac{7n+1}{4n+27}$$ 1

$$\Rightarrow \quad \frac{a + \left(\frac{n-1}{2}\right)d}{a' + \left(\frac{n-1}{2}\right)d'} = \frac{7n+1}{4n+27}$$ 1

To get ratio of $9^{th}$ terms, replacing $\frac{n-1}{2} = 8$

$\Rightarrow \quad n = 17$ 1

Hence $\frac{t_9}{t_9'} = \frac{a+8d}{a'+8d'} = \frac{120}{95}$ or $\frac{24}{19}$ 1

**28.** $(x-1)^2 + (2x+1)^2 = 2(2x+1)(x-1)$ 1

$\Rightarrow \quad x^2 + 1 - 2x + 4x^2 + 1 + 4x = 4x^2 - 4x + 2x - 2$ 1

$\Rightarrow \quad x^2 + 4x + 4 = 0$ $\frac{1}{2}$

$\Rightarrow \quad (x + 2)^2 = 0$ 1

$\Rightarrow \quad x = -2$ $\frac{1}{2}$

**29.** Let B take x days to finish the work.

Therefore number of days taken by A = x – 6 $\frac{1}{2}$

Work done by both in one day is

$$\frac{1}{x} + \frac{1}{x-6} = \frac{1}{4}$$ 1

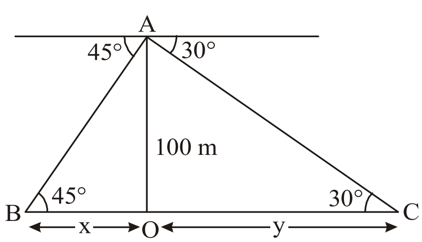
$\Rightarrow \quad x^2 - 14x + 24 = 0$ 1

$\Rightarrow \quad (x - 12)(x - 2) = 0$

$\Rightarrow \quad x = 12$ or $x = 2$ 1

$x \neq 2 \quad \therefore$ B takes 12 days to complete the work $\frac{1}{2}$

**30.**




Correct Figure 1

$\frac{100}{x} = \tan 45° = 1$

$\Rightarrow \quad x = 100 \quad$ ...(i) $\frac{1}{2}$

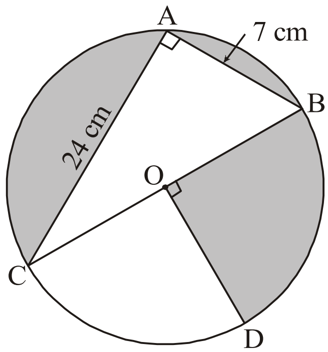
$\frac{100}{y} = \tan 30° = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad y = 100\sqrt{3} \quad$ ...(ii) 1

Distance between the cars $= x + y = 100(\sqrt{3} + 1)$ 1

$= 273.2$ m $\frac{1}{2}$

**31.**




Diameter $BC = \sqrt{24^2 + 7^2} = 25$ cm $\frac{1}{2}$

Area $\Delta CAB = \frac{1}{2} \times 24 \times 7 = 84 \text{ cm}^2$ 1

Area of shaded region $= \frac{\pi}{2}\left(\frac{25}{2}\right)^2 - 84 + \frac{\pi}{4}\left(\frac{25}{2}\right)^2$ 1

$= \left(\frac{1875\pi}{16} - 84\right) \text{cm}^2$ 1

$= (117.18\pi - 84) \text{ cm}^2$ $\frac{1}{2}$

or $= 283.94 \text{ cm}^2$