**REG-POC-2324-ASM-SET 3-MATH**
**Suggested solutions**

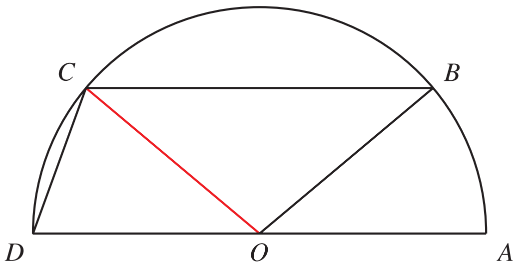
**Multiple Choice Questions**

| | | | | |
|---|---|---|---|---|
| 1. B | 2. C | 3. A | 4. B | 5. D |
| 6. C | 7. D | 8. A | 9. C | 10. C |
| 11. C | 12. C | 13. D | 14. B | 15. C |
| 16. D | 17. C | 18. C | 19. C | 20. D |
| 21. B | 22. A | 23. B | 24. D | 25. C |
| 26. C | 27. B | 28. C | 29. B | 30. C |

1. $\boxed{\text{B}}$

Join $OC$ (to use the property from equal arcs)

Reflex $\angle BOD = 2 \times 110° = 220°$
$\angle AOB = 220° - 180° = 40°$
$\angle COD = \angle AOB = 40°$
$\angle COB = 180° - 2 \times 40° = 100°$
$\angle OBC = \angle OCB = \dfrac{180° - 100°}{2} = 40°$




2. $\boxed{\text{C}}$

$\angle POS = \angle ROS = \dfrac{136°}{2} = 68°$
$\angle SPO = \angle PSO = \dfrac{180° - 68°}{2} = 56°$

3. $\boxed{\text{A}}$

Reflex $\angle AOD = 70° \times \dfrac{3}{1} = 210°$
$\angle AOD = 360° - 210° = 150°$
$\angle ACD = \dfrac{150°}{2} = 75°$

4. $\boxed{\text{B}}$

$\angle AOC = \angle BOD$
$\angle AOD = \angle BOC = \dfrac{180° - 48°}{2} = 66°$
$\angle ABD = \dfrac{180° - 66° - 48°}{2} = 33°$

5. $\boxed{\text{D}}$

$\angle OCB = 68°$ and $\angle BOC = 180° - 68° - 68° = 44°$.
$\angle COD = \angle AOB = x$
$x + 44° + x = 180°$

$$x = 68°$$

6. $\boxed{\text{C}}$

$\angle AOB = \angle BOC = \dfrac{100°}{2} = 50°$
$\angle OAB = \angle OBA$
$\angle OAB = \dfrac{180° - 50°}{2} = 65°$

7. $\boxed{\text{D}}$

I. ✓. Note that $\angle AOB = \angle BOC = \angle COD = \ldots = \angle FOA$.
$\angle EOF = \dfrac{360°}{6} = 60°$

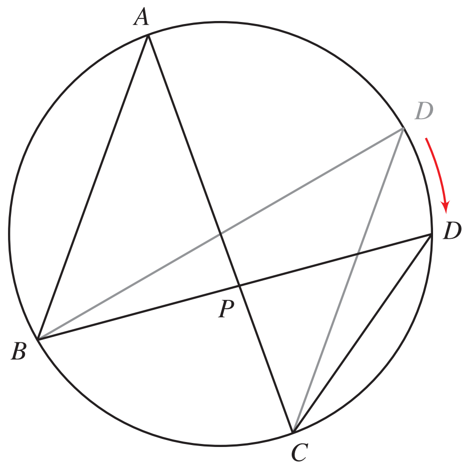
II. ✓. Since $\overset{\frown}{AB} = \overset{\frown}{DE}$, $AB = DE$.

III. ✓. Since all arcs are equal, all chords are also equal.
It is a regular hexagon.

8. $\boxed{\text{A}}$

I. ✓. $\angle APB = \angle CPD$ *(vert. opp. $\angle$s)*

II. ✗. Consider the following figure. Point $D$ is shifted clockwise. Chords $AC$ and chords $BD$ intersect at $P$.




Note that $\overset{\frown}{AB}$ remains unchanged, while $\overset{\frown}{CD}$ becomes shorter.
Thus, the equation $\overset{\frown}{AB} = \overset{\frown}{CD}$ cannot be true.

III. ✗. Consider the above figure.
$AB$ remains unchanged, while $CD$ becomes shorter.
Thus, the equation $AB = CD$ cannot be true.

9. $\boxed{\text{C}}$

$\angle PQR = 90°$
$\angle PRQ = \dfrac{180° - 90°}{2} = 45°$
$\angle PQS = 90° - 18° = 72°$
$\angle SRP = \angle SQR = 72°$
$\angle QRS = 72° + 45° = 117°$

10. $\boxed{\text{C}}$

$\angle AOP = \angle POQ = \angle QOC = \dfrac{180° - 90°}{3} = 30°$
$\angle CPQ = \dfrac{1}{2}\angle COP = 15°$
$\angle AQP = \dfrac{1}{2}\angle AOP = 15°$
$\angle ARC = \angle PRQ = 180° - 15° - 15° = 150°$

11. $\boxed{\text{C}}$

$\angle AOC = \angle COE = \dfrac{180°}{2} = 90°$
Reflex $\angle AOC = 360° - 90° = 270°$
$\angle ABC = \dfrac{270°}{2} = 135°$

12. $\boxed{\text{C}}$

$\angle FDE = 145° - 15° = 130°$
$\angle ADC = 180° - 130° = 50°$
$\angle AOC = 2\angle ADC = 100°$
$\angle BOC = \angle AOB = \dfrac{100°}{2} = 50°$
$\angle OCE = \angle BOC - \angle CEO = 50° - 15° = 35°$

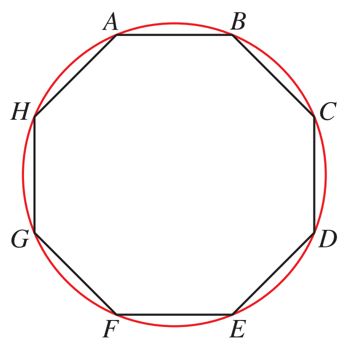
13. $\boxed{\text{D}}$

Refer to the figure. Note that every regular polygon is cyclic.

I. ✓. The graph is symmetric about $DH$.
So, $AG \perp DH$ and $BF \perp DH$.
Thus, $AG // BF$.

II. ✓. Since $\overset{\frown}{BD} = \overset{\frown}{EG}$, $BD = EG$.

III. ✓. $\angle CAG : \angle BDH = \overset{\frown}{CEG} : \overset{\frown}{BAH} = 2 : 1$
Thus, $\angle CAG = 2\angle BDH$.



14. $\boxed{B}$

Note that regular hexagon is cyclic.

Since $BC = CD = DE = EF$, we have $\angle BAC = \angle CAD = \angle DAE = \angle EAF$.

$\angle BAF = \dfrac{(6-2)180^\circ}{6} = 120^\circ$

$x + y = 120^\circ \times \dfrac{2}{4} = 60^\circ$

15. $\boxed{C}$

Let $\angle ADB = x$. Then $\angle CAD = 2x$.

$$\begin{aligned} \angle CED &= \angle ADB + \angle CAD \\ 87^\circ &= x + 2x \\ x &= 29^\circ \end{aligned}$$

16. $\boxed{D}$

$\angle AOB = 24^\circ \times 2 = 48^\circ$

$\angle BOC = 48^\circ \times \dfrac{3}{2} = 72^\circ$

$\angle AOC = 48^\circ + 72^\circ = 120^\circ$

$\angle OAC = \dfrac{180^\circ - 120^\circ}{2} = 30^\circ$

17. $\boxed{C}$

$\angle PRQ : \angle QPR : \angle PQR = \overset{\frown}{PQ} : \overset{\frown}{QR} : \overset{\frown}{PR} = 2 : 3 : 4$

$\angle PQR = 180^\circ \times \dfrac{4}{2+3+4} = 80^\circ$

18. $\boxed{C}$

Let $O$ be the centre.

$\angle OBA = \angle BAC = 36^\circ$

$\angle AOB = 180^\circ - 36^\circ - 36^\circ = 108^\circ$

$\dfrac{\overset{\frown}{AC}}{\overset{\frown}{AB}} = \dfrac{\angle AOC}{\angle AOB}$

$\dfrac{\overset{\frown}{AC}}{9} = \dfrac{180^\circ}{108^\circ}$

$\overset{\frown}{AC} = 15\text{ cm}$

19. $\boxed{C}$

$\angle BDA : \angle BDC = \overset{\frown}{AB} : \overset{\frown}{BC} = 1 : 2$

$\angle BDC = 84^\circ \times \dfrac{2}{1+2} = 56^\circ$

20. $\boxed{\text{D}}$

$$\frac{\angle ABD}{\angle BAC} = \frac{\overset{\frown}{AD}}{\overset{\frown}{BC}}$$
$$\frac{\angle ABD}{28^\circ} = \frac{1}{2}$$
$\angle ABD = 14^\circ$
$\angle ADB = 90^\circ$
$\angle CAD = 180^\circ - 90^\circ - 28^\circ - 14^\circ = 48^\circ$

21. $\boxed{\text{B}}$

Let $\angle ABD = 3\theta$. Then $\angle ACB = 3\theta$, $\angle BAC = 2\theta$ and $CBD = 4\theta$.
$2\theta + (3\theta + 4\theta) + 3\theta = 180^\circ$
$\theta = 15^\circ$
$\angle BFC = 2\theta + 3\theta = 75^\circ$
$\angle ACE = 75^\circ - 40^\circ = 35^\circ$

22. $\boxed{\text{A}}$

$\angle POQ = 360^\circ - 100^\circ - 90^\circ - 50^\circ = 120^\circ$
$$\frac{\overset{\frown}{SR}}{\overset{\frown}{PQ}} = \frac{\angle SOR}{\angle POQ}$$
$$= \frac{90^\circ}{120^\circ}$$
$\overset{\frown}{SR} : \overset{\frown}{PQ} = 3 : 4$

23. $\boxed{\text{B}}$

$\angle AOB : \angle BOC : \angle COD = \overset{\frown}{AB} : \overset{\frown}{BC} : \overset{\frown}{CD}$
$= 2 : 1 : 1$
$\angle OAD = \angle ODA = 34^\circ$
$\angle AOD = 180^\circ - 34^\circ - 34^\circ = 112^\circ$
Reflex $\angle AOD = 360^\circ - 112^\circ = 248^\circ$
$\angle COD = 248^\circ \times \dfrac{1}{2+1+1} = 62^\circ$
$\angle AOC = 112^\circ + 62^\circ = 174^\circ$
$\angle ABC = \dfrac{1}{2}\angle AOC = 87^\circ$

24. $\boxed{\text{D}}$

$\angle AOB : \angle BOC : \angle COA = 5 : 4 : 3$
$\angle AOB = 360^\circ \times \dfrac{5}{5+4+3} = 150^\circ$
$\angle OBA = \dfrac{180^\circ - 150^\circ}{2} = 15^\circ$

25. $\boxed{\text{C}}$

Let $\angle PRQ = \theta$.
Since $PQ = QR = RS$, we have $\angle QSR = \angle SQR = \theta$.
Since $\overparen{PS} : \overparen{RS} = 2 : 1$, we have $\angle PRS = 2\theta$.
In $\triangle QRS$,

$$\theta + (\theta + 2\theta) + \theta = 180^\circ$$
$$\theta = 36^\circ$$

$\angle PES = 2\theta + \theta = 108^\circ$

26. $\boxed{\text{C}}$

Let $O$ be the centre of the semi-circle $APQRSB$.
$\angle AOQ = 180^\circ \times \dfrac{2}{5} = 72^\circ$
$\angle ABQ = \dfrac{\angle AOQ}{2} = 36^\circ$
$\angle BOS = 180^\circ \times \dfrac{1}{5} = 36^\circ$
$\angle BAS = \dfrac{\angle BOS}{2} = 18^\circ$
$\angle AKQ = 18^\circ + 36^\circ = 54^\circ$

27. $\boxed{\text{B}}$

I. ✓. Note that $12^2 + 12.6^2 = 302.76 = 17.4^2$.
We have $\angle BAC = 90^\circ$ and $BC$ is a diameter of the circle.
Radius $= \dfrac{BC}{2} = 8.7\,\text{cm}$

II. ✗. Note that $\dfrac{\overparen{AC}}{\overparen{AB}} \neq \dfrac{AC}{AB} = \dfrac{21}{20}$ in general.
Let $O$ be the centre of the circle.
$$12.6^2 = 8.7^2 + 8.7^2 - 2(8.7)(8.7)\cos\angle AOC$$
$\angle AOC \approx 92.8^\circ$
$$12^2 = 8.7^2 + 8.7^2 - 2(8.7)(8.7)\cos\angle AOB$$
$\angle AOB \approx 87.2^\circ$
$$\frac{\overparen{AC}}{\overparen{AB}} = \frac{\angle AOC}{\angle AOB} \approx 1.06 \neq \frac{21}{20}$$

III. ✓. $BC$ is a diameter and $\angle BAC = 90^\circ$.
$\cos\angle ACB = \dfrac{AC}{BC} = \dfrac{21}{29}$

28. $\boxed{\text{C}}$

$\angle DCA = 180^\circ - 120^\circ = 60^\circ$
$\angle BDC = \angle ABD \times \dfrac{3+4}{4+6} = 84^\circ$
$\angle EDB = 180^\circ - 84^\circ = 96^\circ$
$\angle AEC = 120^\circ - 96^\circ = 24^\circ$

29. $\boxed{\text{B}}$

$\angle ABD = 15° + 25° = 40°$

$\angle ADB = 90°$

$\angle BAD = 180° - 90° - 40° = 50°$

$$\frac{\overset{\frown}{AD}}{\overset{\frown}{BQD}} = \frac{\angle ABD}{\angle BAD} = \frac{40°}{50°} = \frac{4}{5}$$

30. $\boxed{\text{C}}$

Let $\angle ADB = \theta$.

Then $\angle BDC = 2\theta$, $\angle CAD = 2\theta$ and $\angle ACD = 3\theta$.

$$\begin{aligned} \angle CAD + \angle ACD + \angle ADC &= 180° \\ 2\theta + 3\theta + (\theta + 2\theta) &= 180° \\ \theta &= 22.5° \end{aligned}$$

$x = 180° - 2\theta - \theta = 112.5°$



**END OF PAPER**