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Cosine Rule - Worksheet

Skill

Group A - Sketch the triangle

Sketch the triangle with the following information.

1) $A = 60°, b = 10cm$
$c = 8cm, a = x$

2) $B = 30°, b = x$
$c = 4.4cm, a = 3.8cm$

3) $C = 45°, b = 4.6m$
$c = x, a = 5.1m$

4) $P = 78°, q = 7km$
$r = 4km, p = x$

5) $X = 52°, y = 16.3$
$z = 22.1, x = a$

6) $a = 8.7cm, b = 11.1cm$
$c = 13.2cm, A = θ$

7) $a = 17m, b = 14m$
$c = 11m, B = θ$

8) $p = 5.32mm, q = 4.3mm$
$r = 6.71mm, R = θ$

9) $x = 7.2mm, y = 5.4mm$
$z = 9.8mm, Z = θ$

Group B - Substitution practice

Substitute the values of b, c and A into the cosine rule and then solve for a:
$a^2 = b^2 + c^2 - 2bc \times \cos(A)$. Round your answers to a suitable degree of accuracy.

1) $b = 3, c = 4, A = 90$

2) $b = 6, c = 8, A = 90$

3) $b = 10, c = 4, A = 60$

4) $b = 8, c = 12, A = 60$

5) $b = 5, c = 5, A = 60$

6) $b = 2.3, c = 4.6, A = 60$

7) $b = 15, c = 8, A = 28$

8) $b = 6, c = 0.8, A = 56$

9) $b = 3.8, c = 7.9, A = 79$

Group C - Substitution practice

Substitute the values of a, b and c into the cosine rule and then solve for A: $\cos(A) = \frac{b^2+c^2-a^2}{2bc}$.
Round your answers to a suitable degree of accuracy.

1) $a = 5, b = 5, c = 5$

2) $a = 5, b = 4, c = 3$

3) $a = 13, b = 5, c = 12$

4) $a = 4, b = 3, c = 5$

5) $a = 2, b = 1, c = 2$

6) $a = 10, b = 7, c = 8$

7) $a = 12, b = 11, c = 2$

8) $a = 9.4, b = 3.6, c = 8.1$

9) $a = 4.21, b = 3.98, c = 6.25$

Cosine Rule - Worksheet

Group D - Using the cosine rule

Find the missing angle θ, or length x, for each triangle. All diagrams are not drawn to scale.

1)

11cm   65°   37cm

x

2)

1.6cm x

39°

2.5cm

3)

7.5m

37.2°

2.1m

x

4)

70mm   116°

x

5)

68cm

53°

61cm

42°

x

6)

4.4m   5.6m

θ

2m

7)

55°

36mm   27mm

θ

11mm

8)

97km

60km

41°

θ

95.8km

9)

11.2

62°

14.8   10.26

θ

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Cosine Rule - Worksheet

Applied

1) Use the cosine rule to find the missing angle θ. Write your answer to 3 significant figures.

2) Graham would like to find out how much time it would take him to run from home H to work W, via the post office PO. His journey would look like this.

Given that he runs at 5min/km, how much time would it take him to get to work via the post office?

3) A wheel alignment check monitors the direction and angle of the wheels of a car to ensure that they are perpendicular to the road, and parallel to each other. The diagram below shows the wheel alignment of a front set of wheels on a car.

If the car travels 100 miles with this mis-alignment, what is the displacement x of tyre A.

Cosine Rule - Exam Questions

1) **(a)** *PQRS* and *WXYZ* are kites. Using the diagram, calculate the length of *QS*, correct to 3 significant figures.

Diagrams not to scale

....

(3)

(b) Calculate the interior angle at *Y* for kite *B*, correct to 2 decimal places.

....

(3)

(6 marks)

---

2) Derek needs to replace a wire fence around a field.
He has $100m$ of wire.

Not to scale

Does Derek have enough wire to go around the field twice?
Give a reason for your answer.

....

(4 marks)

Cosine Rule - Exam Questions

3)   A bridge is being constructed over a river. Using the diagram below,
calculate the interior angle x. You must show your working.

....

(3 marks)

---

4)   (a)   An isosceles triangle is inscribed in a circle. Use the cosine rule
to find the length of BC. Write your answer to 3 significant
figures.

....

(3)

(b)   Two radii are added to the same diagram connecting OB and OC
as shown below. Calculate the radius of the circle using the
cosine rule.

....

(5)

(8 marks)

Cosine Rule - Exam Questions

5) **(a)** Two planes set off from the same airport. Plane A flies at a bearing of 130° and Plane B flies at a bearing of 200°. After 30 minutes, Plane A has travelled $21.4km$, and Plane B has travelled $16.9km$.
Given that the planes are flying at the same height, how far apart are they from each other, 30 minutes after take off? Write your answer correctly to 2 decimal places.

Not to scale

....

(3)

(b) Plane C takes off from the same airport at the same time at a bearing of 155° travelling $27.3km$ in 30 minutes. How far is A from C, 30 minutes after take off?

....

(3)

(c) 30 minutes after take off, the distance $BC = 19.45km$. Using your answer for parts (a) and (b), calculate the angle BAC, labelled θ.

....

(3)

(9 marks)

Cosine Rule - Answers

	Question	Answer
	Skill Questions	
Group A	Sketch the triangle with the following information: **1)** $A = 60°, b = 10cm, c = 8cm, a = x$	**1)**
	2) $B = 30°, b = x, c = 4.4cm, a = 3.8cm$	**2)**
	3) $C = 45°, b = 4.6m, c = x, a = 5.1m$	**3)**
	4) $P = 78°, q = 7km, r = 4km, p = x$	**4)**

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Cosine Rule - Answers

Group A cont.	**5)** $X = 52°, y = 16.3, z = 22.1, x = a$	**5)**
	6) $a = 8.7cm, b = 11.1cm,$ $c = 13.2cm, A = \theta$	**6)**
	7) $a = 17m, b = 14m, c = 11m, B = \theta$	**7)**
	8) $p = 5.32mm, q = 4.3mm,$ $r = 6.71mm, R = \theta$	**8)**
	9) $x = 7.2mm, y = 5.4mm,$ $z = 9.8mm, Z = \theta$	**9)**

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Cosine Rule - Answers

Group B	Substitute the values of b, c and A into the cosine rule and then solve for a: $a^2 = b^2 + c^2 - 2bc \times \cos(A)$. Round your answers to a suitable degree of accuracy.	
	1) $b = 3$, $c = 4$, $A = 90$	**1)** 5
	2) $b = 6$, $c = 8$, $A = 90$	**2)** 10
	3) $b = 10$, $c = 4$, $A = 60$	**3)** 8.72 (2dp)
	4) $b = 8$, $c = 12$, $A = 60$	**4)** 10.58 (2dp)
	5) $b = 5$, $c = 5$, $A = 60$	**5)** 5
	6) $b = 2.3$, $c = 4.6$, $A = 60$	**6)** 3.98 (2dp)
	7) $b = 15$, $c = 8$, $A = 28$	**7)** 8.78 (2dp)
	8) $b = 6$, $c = 0.8$, $A = 56$	**8)** 5.59 (2dp)
	9) $b = 3.8$, $c = 7.9$, $A = 79$	**9)** 8.09 (2dp)
Group C	Substitute the values of a, b and c into the cosine rule and then solve for A: $\cos(A) = \frac{b^2+c^2-a^2}{2bc}$. Round your answers to a suitable degree of accuracy.	
	1) $a = 5$, $b = 5$, $c = 5$	**1)** $A = 60^o$
	2) $a = 5$, $b = 4$, $c = 3$	**2)** $A = 90^o$
	3) $a = 13$, $b = 5$, $c = 12$	**3)** $A = 90^o$
	4) $a = 4$, $b = 3$, $c = 5$	**4)** $A = 53.13^o$
	5) $a = 2$, $b = 1$, $c = 2$	**5)** $A = 75.52^o$
	6) $a = 10$, $b = 7$, $c = 8$	**6)** $A = 83.33^o$
	7) $a = 12$, $b = 11$, $c = 2$	**7)** $A = 115.58^o$
	8) $a = 9.4$, $b = 3.6$, $c = 8.1$	**8)** $A = 99.66^o$
	9) $a = 4.21$, $b = 3.98$, $c = 6.25$	**9)** $A = 41.64^o$

Cosine Rule - Answers

Group D	Find the missing angle θ, or length x, for each triangle. All diagrams are not drawn to scale.	
	1) 11cm 65° 37cm x	**1)** $x = 33.85cm$
	2) 1.6cm x 39° 2.5cm	**2)** $x = 1.61cm$
	3) 7.5m 37.2° 2.1m x	**3)** $x = 5.96m$
	4) 70mm 116° x	**4)** $x = 118.73mm$
	5) 53° 68cm 61cm 42° x	**5)** $x = 57.90cm$

Cosine Rule - Answers

| Group D cont. | 6)

 4.4m   5.6m
 θ
 2m

 7)
 55°
 36mm   27mm
 θ
 11mm

 8)
 97km
 60km
 41°
 θ
 95.8km

 9)
 11.2
 62°
 14.8   10.26
 θ | 6) $\theta = 44.42^o$

 7) $\theta = 29.69^o$

 8) $\theta = 72.96^o$

 9) $\theta = 49.09^o$ |

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Cosine Rule - Answers

	Question	Answer
	Applied Questions	
1)	Use the cosine rule to find the missing angle θ. Write your answer to 3 significant figures. B 35mm 95° 4.7cm θ A 58mm C	54.1^o
2)	Graham would like to find out how much time it would take him to run from home H to work W, via the post office PO. His journey would look like this. H 6km W 26° 5km PO Given that he runs at 5min/km, how much time would it take him to get to work via the post office?	H to $PO = 2.66km$ H to W via $PO = 7.66km$ $7.66 \times 5 = 38.3$ minutes 38 mins 17 seconds
3)	A wheel alignment check monitors the direction and angle of the wheels of a car to ensure that they are perpendicular to the road, and parallel to each other. The diagram below shows the wheel alignment of a front set of wheels on a car. x 0.02° 0.02° A B If the car travels 100 miles with this mis-alignment, what is the displacement x of tyre A.	$0.035 \ miles$

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Cosine Rule - Mark Scheme

	Question	Answer	
	Exam Questions		
1) (a)	$PQRS$ and $WXYZ$ are kites. Using the diagram, calculate the length QS correct to 3 significant figures.	**(a)** Correct substitution into the cosine rule	**(1)**
		$a^2 = 5527.57...$ or $a = 74.3476...$	**(1)**
		$74.3cm$	**(1)**
(b)	Calculate the interior angle at Y for kite B, correct to 2 decimal places.	**(b)** Correct substitution into the cosine rule	**(1)**
		$\cos(Y) = -\frac{83}{308}$ or $Y = 105.633357...$	**(1)**
		105.63°	**(1)**
2)	Derek needs to replace a wire fence around a field. He has $100m$ of wire. Does Derek have enough wire to go around the field twice? Give a reason for your answer.	Correct substitution into the cosine rule	**(1)**
		$x = 17.69...$	**(1)**
		$P = 48.347...$ or $2P = 96.783...$	**(1)**
		Yes.	
			(1)
3)	A bridge is being constructed over a river. Using the diagram below, calculate the interior angle x. You must show your working.	Correct substitution into the cosine rule	**(1)**
		$\cos x = \frac{9}{16}$ or $x = 55.77113...$	**(1)**
		55.77^{o}	**(1)**

Cosine Rule - Mark Scheme

4)	**(a)**	An isosceles triangle is inscribed in a circle. Use the cosine rule to find the length of BC. Write your answer to 3 significant figures.	**(a)**	Correct substitution into the cosine rule $a^2 = 67.379...$ or $a = 8.20848...$ $8.21cm$	**(1)** **(1)** **(1)**
	(b)	Two radii are added to the same diagram connecting OB and OC as shown below. Calculate the radius of the circle.	**(b)**	Angle $BOC = 40 \times 2 = 80^o$ Reason: The angle at the centre is twice the angle at the circumference. $8.21^2 = x^2 + x^2 - 2x^2\cos(80)$ $x^2 = \frac{8.21^2}{2 - 2\cos(80)}$ $x = 6.39cm$ (2dp)	**(1)** **(1)** **(1)** **(1)** **(1)**
5)	**(a)**	Two planes set off from the same airport. Plane A flies at a bearing of 130° and Plane B flies at a bearing of 200°. After 30 minutes, Plane A has travelled $21.4km$, and Plane B has travelled $16.9km$. Given that the planes are flying at the same height, how far apart are they from each other, 30 minutes after take off? Write your answer correctly to 2 decimal places.	**(a)**	Correct substitution into the cosine rule $AB^2 = 496.1799899...$ or $AB = 22.27509798...$ $22.28km$	**(1)** **(1)** **(1)**

Cosine Rule - Mark Scheme

(b)	Plane C takes off from the same airport at the same time at a bearing of $155°$ travelling $27.3km$ in 30 minutes. How far is A from C, 30 minutes after take off? N B A C	**(b)**	Correct substitution into the cosine rule $AC^2 = 144.2837293...$ or $AC = 12.01181624...$ $12.01km$ (2dp)	**(1)** **(1)** **(1)**
(c)	30 minutes after take off, the distance $BC = 19.45km$. Using your answer for parts (a) and (b), calculate the angle BAC labelled θ. N B θ A C	**(c)**	Correct substitution into the cosine rule $\cos\theta = \frac{22.28^2 + 12.01^2 - 19.45^2}{2 \times 22.28 \times 12.01}$... or $\theta = \cos^{-1}(0.4901959319)...$ $\theta = 60.65^o$	**(1)** **(1)** **(1)**