School Name
Mathematics Test 2017

Non-Right Triangle Trigonometry

Year 10

Skills and Knowledge Assessed:
- Apply Pythagoras' theorem and trigonometry to solving three - dimensional problems in right-angled triangles (ACMMG276)
- Use the unit circle to define trigonometric functions, and graph them with and without the use of digital technologies (ACMMG274)
- Solve simple trigonometric equations (ACMMG275)
- Establish the sine, cosine and area rules for any triangle and solve related problems (ACMMG273)
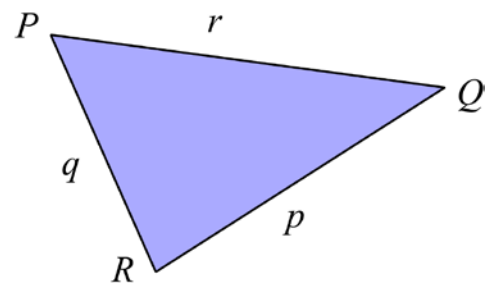
Name_____

Section 1   Short Answer Section

Write all working and answers in the spaces provided on this test paper.

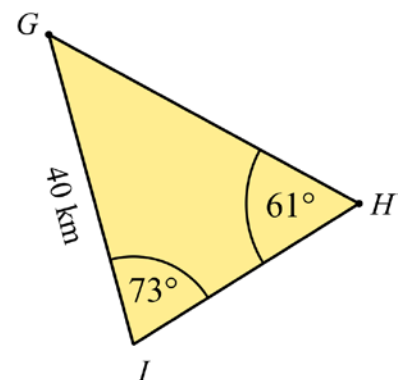|	
1.	Complete the statement of the cosine rule below for ΔPQR? …………………………………………….... $\cos R =$ …………………………

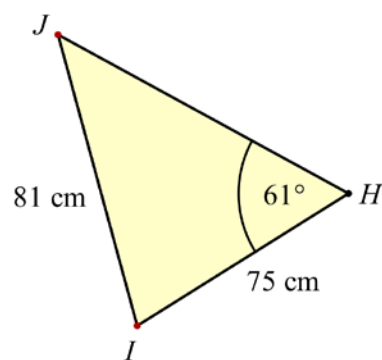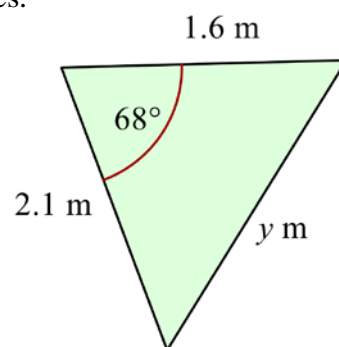|	
2.	Write a statement of the sine rule which could be used to find the distance GH ? (You do not need to complete the calculation and find GH.) ……………………………………………… …………………………………………….... ……………………………………………… …………………………………………….

3. Find the size of $\angle J$ in Δ HIJ, correct to the nearest degree.

....

....

....

....

81 cm

61° H

75 cm

J

I

4. Use the cosine rule to find the value of w, correct to 2 significant figures.

....

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1.6 m

68°

2.1 m

y m

5. Find the area of the triangle shown.

....

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....

....

36 m

98°

25 m
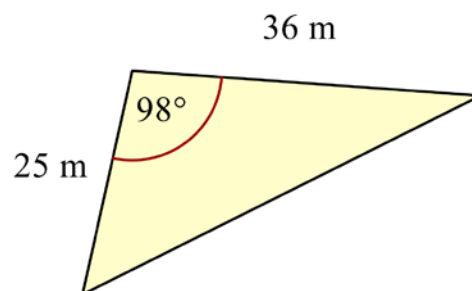
6. Solve $2 \sin x = 1$ for $0° \leq x° \leq 180°$.

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7. Calculate the value of β correct to the nearest degree.

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25 m

$\beta°$

22 m

14 m
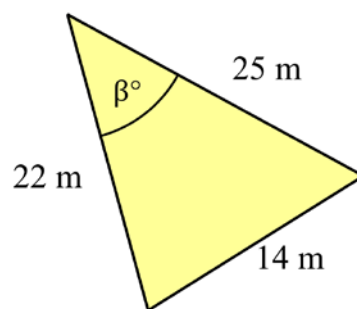
8. Find the value of t, to the nearest millimetre.

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65 cm

54°

t cm

82°
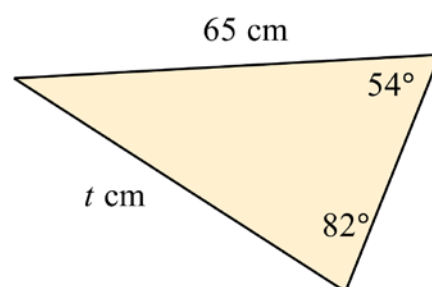
9. Find the area of this triangle, correct to the nearest square centimetre.

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35°

58 cm

100°

42 cm
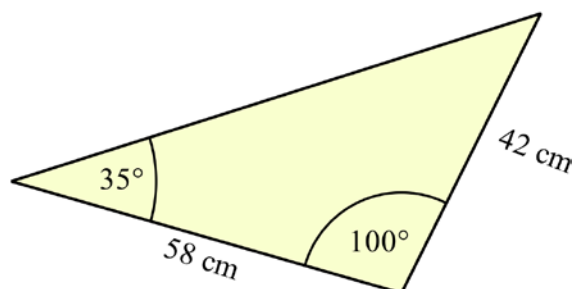
10. In the rectangular prism shown, $TU = 150$ cm $UX = 80$ cm and $UY = 120$ cm.

Find the size of $\angle VTU$.

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T

U

S

V

W

X

Z

Y
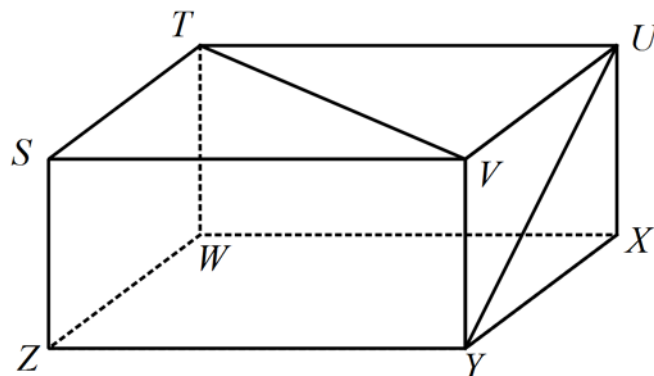
11.   A lighthouse N is on top of a cliff.

The direct distance from ship S to N is 4100 m and from ship T to N is 3600 m.
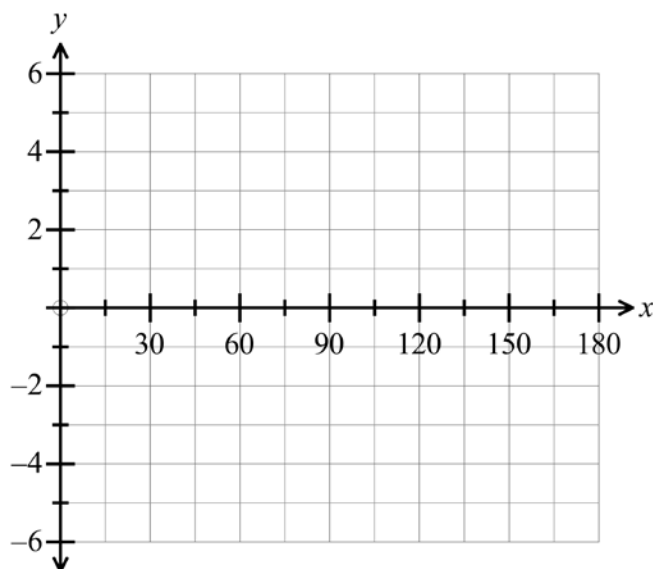
The two ships are in a straight line to the lighthouse and are 900 m apart.

What is the angle of elevation of the lighthouse from ship T?

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4100 m

3600 m

N

S 900 m T
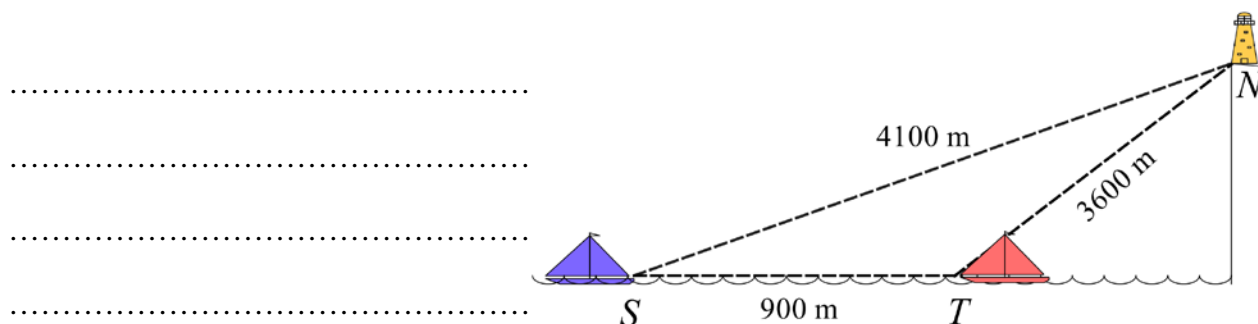
12.   Complete the table below and use it to draw a sketch of $y = \tan x$ for $0° \leq x \leq 180°$.

x	0º	30º	45º	60º	90º	120º	135º	150º	180º
$\tan x$									

13.	Ship *R* is 200 km on a bearing of 048º from Port *P*.
	Ship *Q* is 185 km from Port *P*.
	Ships *Q* and *R* are 325 km apart.
	Calculate the bearing of *Q* from *P*.

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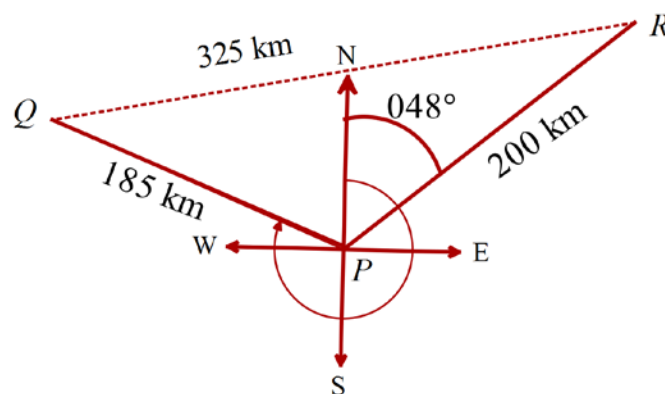
14.	Given that $\cos x° = 1$. Find the values of *x* if $0 \leq x \leq 180$.

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15.	A tower *VX* has an angle of elevation of 20º when viewed from *U* which is 150 m away from *X* on level ground.
	It has an angle of elevation of 28º when viewed from *W* which is in the same plane as *U* and *X*.
	How far is *W* from *X*?
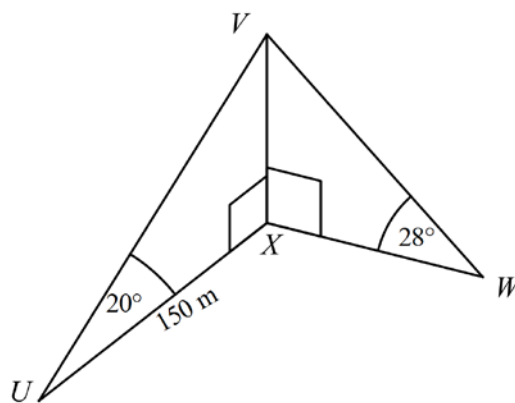
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Non-Right Triangle Trigonometry

Year 10

Calculator Allowed

Name_____

Section 2   Multiple Choice Section

Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.
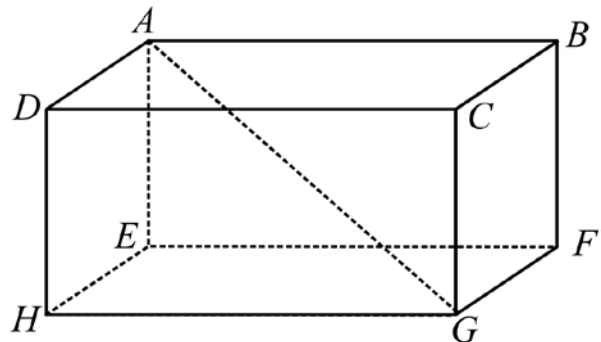
1. Which of the following could **not** be used to find the size of $\angle W$ in $\Delta\ WXY$?

   A. $\dfrac{\sin W}{w} = \dfrac{\sin X}{x}$

   B. $\dfrac{\sin W}{w} = \dfrac{\sin Y}{y}$

   C. $\cos W = \dfrac{x^2 + y^2 - w^2}{2 \times x \times y}$

   D. $\cos W = \dfrac{w^2 + y^2 - x^2}{2 \times w \times y}$
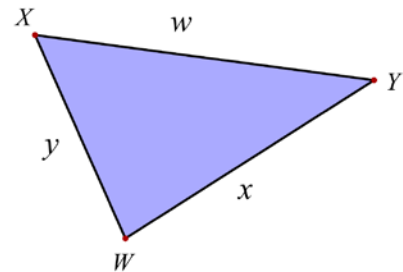
2. Which expression could be used to find the length of the diagonal AG in the rectangular prism shown.

   A. $AG = AE \tan \angle\ AGE$

   B. $AG = \dfrac{AE}{\sin \angle AGE}$

   C. $AG = AE \sin \angle\ AGE$

   D. $AG = \dfrac{AE}{\tan \angle AGE}$

3. Use the sine rule to find the size of ∠ P correct to the nearest degree.

    A.   21°
    B.   40°
    C.   44°
    D.   46°
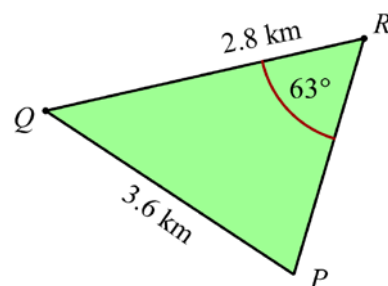
4. Use the cosine rule to find the value of x, correct to the nearest metre.

    A. $x = 119$
    B. $x = 180$
    C. $x = 410$
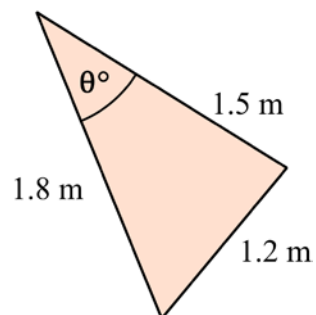   D. $x = 445$
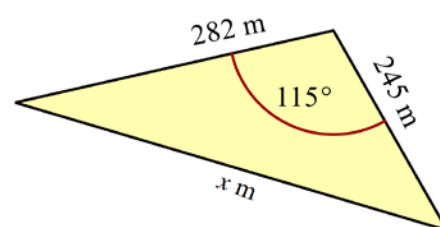
5. Which equation would best describe the graph shown below?
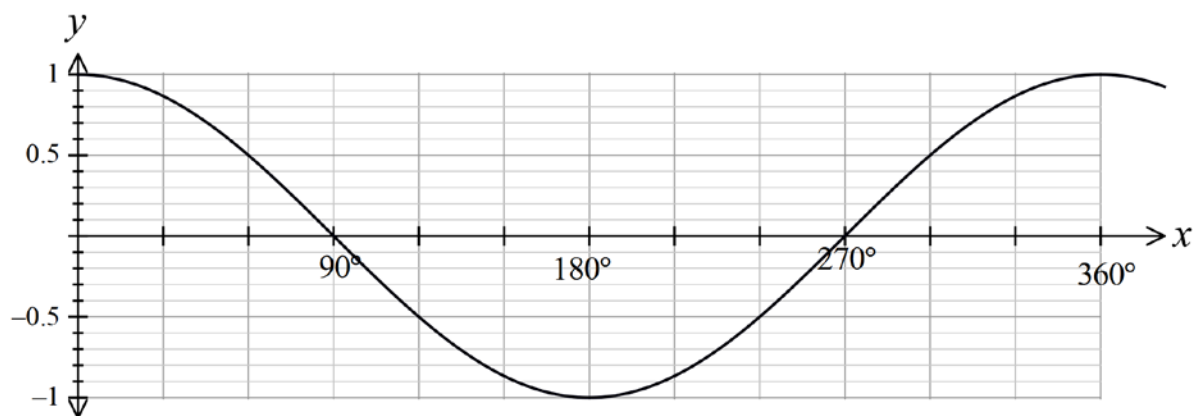
    A. $y = \cos x$
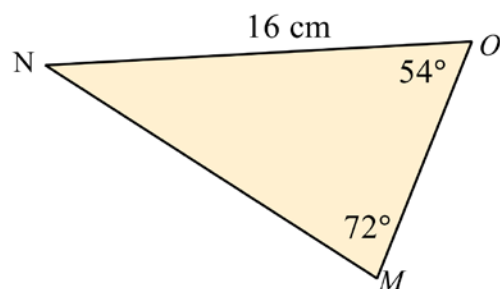   B. $y = \sin x$
    C. $x = \sin y$
    D. $x = \cos y$

6. What is the value of θ ?

    A. $\theta = 33$
    B. $\theta = 41$
    C. $\theta = 56$
    D. $\theta = 83$

1.5 m

1.8 m

1.2 m

7. Find the length of the side *MN*.

    A.   3.7 cm
    B.   12.9 cm
    C.   13.6 cm
    D.   18.8 cm

16 cm

54°

72°

8. Find the area of Δ *ABC*.
    Answer to the nearest cm².

    A.   985 cm²
    B.   995 cm²
    C.   1000 cm²
    D.   1970 cm²

40 cm   100°   50 cm
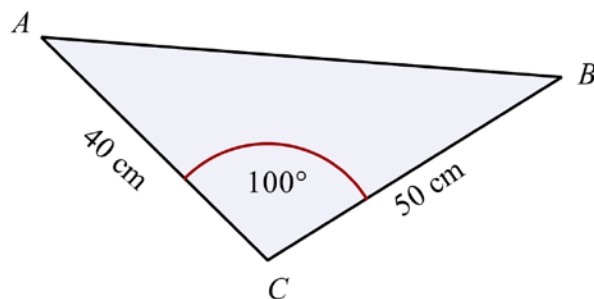
9. Find the value of γ between 0° and 90° such that $\sin \gamma = \dfrac{1}{\sqrt{2}}$.

    Answer to the nearest degree.

    A. $\gamma = 15°$
    B. $\gamma = 30°$
    C. $\gamma = 45°$
    D. $\gamma = 60°$

10. Three points *A*, *B* and *C* are shown on a map, along with the compass bearings of two of the points

What is the size of ∠*ABC* ?

    A.   63º

    B.   83º

    C.   87º

    D.   93º

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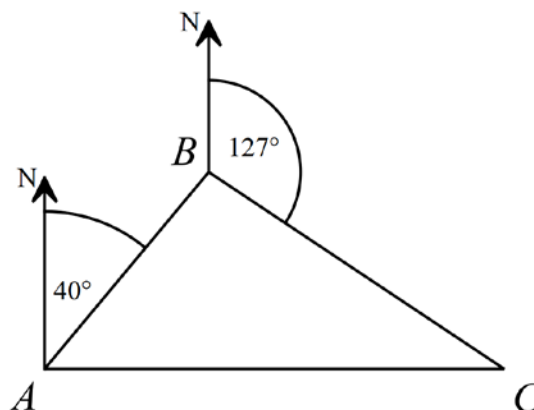
11. In △*EFG*, *EG* = 56 cm, *EF* = 63 cm and ∠*EGF* = 62°.

Calculate the size of ∠*EFG* .

    A.   45º

    B.   52º

    C.   62º

    D.   65º

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12. Two hikers leave the same camp ground at the same time.

Michael hikes 12.5 km on a bearing 220º.

Ben hikes 15.5 km on a bearing 295º.

How far apart are the two hikers?

    A.   4.0 km

    B.   8.3 km

    C.   17.2 km

    D.   18.6 km

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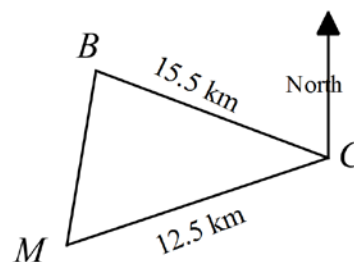
13. If $\cos\theta = 0.8$ and θ lies between 0° and 180°, which statement describes all the possible values of θ ?

    A. $\theta = 37°$ only.

    B. $\theta = 37°$ or $143°$.

    C. $\theta = 53°$ or $127°$

    D. $\theta = 143°$ only.

14.   The diagram shows two right angled triangles which share a common side *BC* in 3 dimensions.

By first finding the length of *BC*, calculate the length of *BD*.

A.   11.7 cm

B.   22.1 cm

C.   28.2 cm

D.   29.4 cm
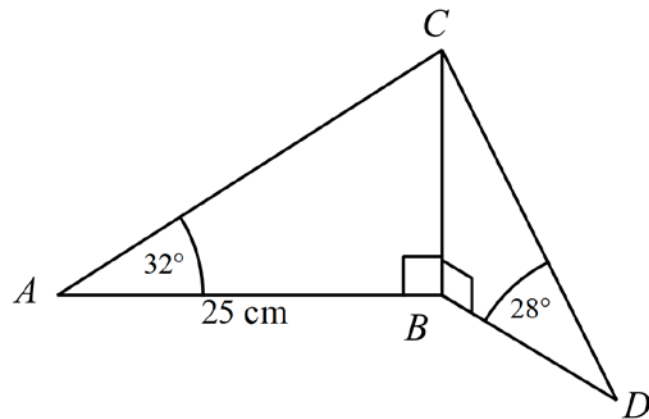
15.   In the △ *PQR, S* is a point on *PR* such that *QS* ⊥ *PR*.

∠*QPR* = 40°, ∠ *QRP* = 56° and *QS* = 25 cm.

Find the length of *PR*, correct to the nearest mm.

A.   6.8 cm

B.   32.4 cm

C.   38.7 cm

D.   46.7 cm
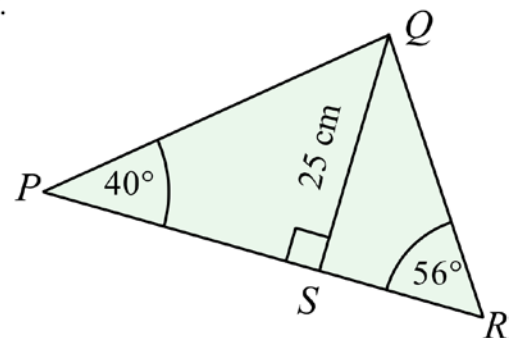
School Name

Mathematics Test 2017

Multiple Choice Answer Sheet

Non-Right Triangle Trigonometry

Name _____

Completely fill the response oval representing the most correct answer.

1. A ◯   B ◯   C ◯   D ◯
2. A ◯   B ◯   C ◯   D ◯
3. A ◯   B ◯   C ◯   D ◯
4. A ◯   B ◯   C ◯   D ◯
5. A ◯   B ◯   C ◯   D ◯
6. A ◯   B ◯   C ◯   D ◯
7. A ◯   B ◯   C ◯   D ◯
8. A ◯   B ◯   C ◯   D ◯
9. A ◯   B ◯   C ◯   D ◯
10. A ◯   B ◯   C ◯   D ◯
11. A ◯   B ◯   C ◯   D ◯
12. A ◯   B ◯   C ◯   D ◯
13. A ◯   B ◯   C ◯   D ◯
14. A ◯   B ◯   C ◯   D ◯
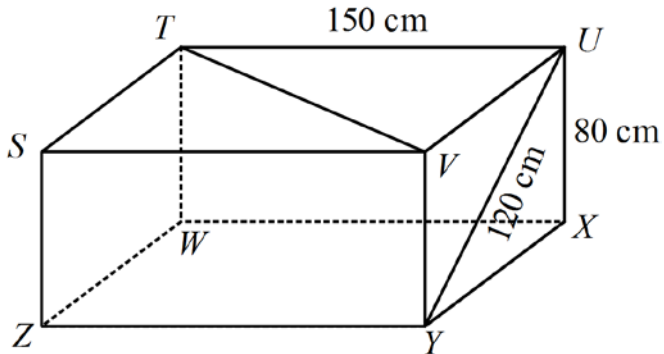15. A ◯   B ◯   C ◯   D ◯

| Year 10 | *Non-Right Triangle Trigonometry* | Non Calculator Section |

ANSWERS

Question	Working and Answer
1.	$\cos R = \dfrac{p^2 + q^2 - r^2}{2pq}$
2.	$\dfrac{GH}{\sin 73°} = \dfrac{40}{\sin 61°}$ OR $GH = \dfrac{40 \sin 73}{\sin 61°}$
3.	$\dfrac{\sin J}{75} = \dfrac{\sin 61°}{81}$ $\sin J = \dfrac{75 \sin 61°}{81}$ $= 0.809833$ $J = \sin^{-1}(0.809833)$ $= 54.0796$ $= \mathbf{54°}$ **(nearest degree)**
4.	$y^2 = 1.6^2 + 2.1^2 - 2 \times 1.6 \times 2.1 \times \cos 68°$ $= 4.45264..$ $y = \sqrt{4.45264}$ $= 2.1101$ $= \mathbf{2.1\ m}$ **(2 sig fig)**
5.	$\text{Area} = \dfrac{1}{2} \times 25 \times 36 \times \sin 98°$ $= 445.62$ $= \mathbf{446\ m^2}$

Question	Working and Answer
6.	$2 \sin x = 1$ $\sin x = \dfrac{1}{2}$ $x = \sin^{-1}\left(\dfrac{1}{2}\right)$ $= 30°$ and $180 - 30$ for $0° \le x° \le 180°$. **$x = 30°$ or $150°$**
7.	$\cos \beta = \dfrac{22^2 + 25^2 - 14^2}{2 \times 22 \times 25}$ $= 0.83$ $\beta = \cos^{-1}(0.83)$ $= 33.90126$ $= \mathbf{34°}$ (**nearest degree**)
8.	$\dfrac{t}{\sin 54°} = \dfrac{65}{\sin 82°}$ $t = \dfrac{65 \sin 54°}{\sin 82°}$ $= 53.10289839$ $= \mathbf{53.1 \ cm}$ (**nearest mm**)
9.	Need two sides and an included angle so use $100°$ angle. $\text{Area} = \dfrac{1}{2} \times 42 \times 58 \times \sin 100°$ $= 1199.495843$ $= \mathbf{1199 \ cm^2}$ **(nearest cm^2)**
10.	Using Pythagoras Theorem $XY^2 = 120^2 - 80^2$ $= 8000$ $XY = \sqrt{8000} = 89.443$ $UV = XY = 89.443$ $\tan \angle VTU = \dfrac{UV}{TU} = \dfrac{89.443}{150}$ $\angle VTU = \tan^{-1}\left(\dfrac{89.443}{150}\right)$ $= 30.806981$ $= \mathbf{31°}$	

Question	Working and Answer
11.	Need to find $\angle STN$ first. $\cos T = \dfrac{3600^2 + 900^2 - 4100^2}{2 \times 3600 \times 900}$ $= -\dfrac{3040000}{6480000}$ $= -0.4691358$ $T = \cos^{-1}(-0.4691358)$ $= 117.9782$ $= 118°$ (nearest degree) Angle of elevation $= 180 - 118$ $\quad = \textbf{62°}$

12.

x	0º	30º	45º	60º	90º	120º	135º	150º	180º
$\tan x$	0	0.577	1.00	1.732	Undef	-1.732	-1.00	-0.577	0

13. Find the size of $\angle QPR.$ $(\angle P)$

$\cos P = \dfrac{185^2 + 200^2 - 325^2}{2 \times 185 \times 200}$

$= -\dfrac{31400}{74000}$

$= -0.424324$

$P = \cos^{-1}(-0.42432)$

$= 115°$

$\angle QPN = 115 - 48 = 67°$

Bearing of $Q = 360 - 67$

$= \textbf{293°}$

Question	Working and Answer
14.	Recalling the sketch of $y = \cos x°$ The only value is $x = 0$
15.	In $\Delta\,UVX$ $\tan 20° = \dfrac{VX}{150}$ $VX = 150\tan 20°$ $ = 54.595535$ In $\Delta\,VXW$ $\tan 28° = \dfrac{VX}{XW}$ $XW = \dfrac{54.595535}{\tan 28°}$ $ = 102.679$ $ = \mathbf{103\ m\,(nearest\ m)}$

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School Name
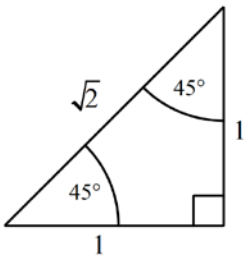**Mathematics Test 2017**

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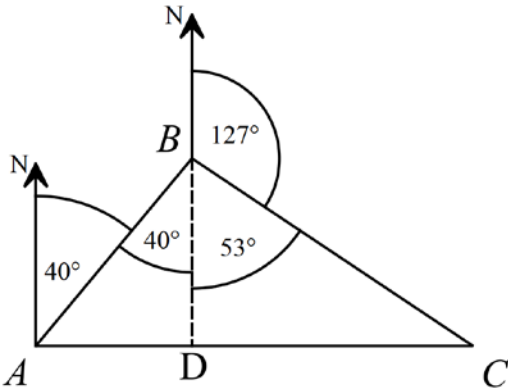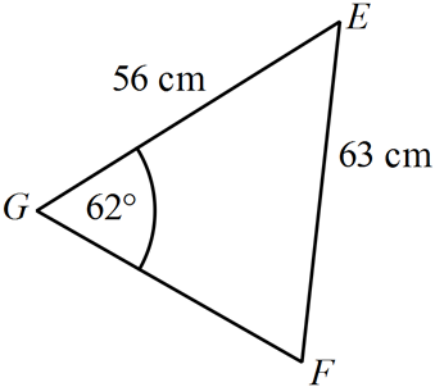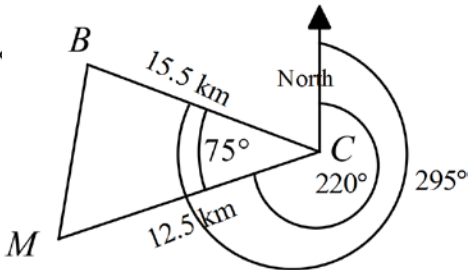
Year 10	*Non-Right Triangle Trigonometry*	Calculator Allowed Multiple Choice Section

ANSWERS

Question	Working	M C Answer
1.	$\cos W = \dfrac{w^2 + y^2 - x^2}{2 \times w \times y}$ has the *w* and *x* terms in the wrong positions.	**D**
2.	$\sin \angle AGE = \dfrac{AE}{AG}$ $AG = \dfrac{AE}{\sin \angle AGE}$	**B**
3.	$\dfrac{\sin P}{2.8} = \dfrac{\sin 63°}{3.6}$ $\sin P = \dfrac{2.8 \times \sin 63°}{3.6}$ $= 0.6930051$ $P = \sin^{-1}(0.6930051)$ $= 43.8684598$ $= 44°$ (nearest degree)	**C**
4.	$x^2 = 282^2 + 245^2 - 2 \times 282 \times 245 \times \cos 115°$ $= 197946.3914$ $x = \sqrt{197946.3914}$ $= 444.9116$ $= 445\ \text{m (nearest m)}$	**D**
5.	Curve is a periodic wave, and has y =1 when x = 0, so since $\cos 0° = 1$, the graph could be $y = \cos x$	**A**

6.	$\cos \theta = \dfrac{1.8^2 + 1.5^2 - 1.2^2}{2 \times 1.8 \times 1.5}$ $\qquad = 0.75$ $\theta = \cos^{-1}(0.75)$ $\qquad = 41.4096221092708$ $\qquad = 41°$ (nearest degree)	**B**
7.	$\dfrac{MN}{\sin 54°} = \dfrac{16}{\sin 72°}$ $MN \div = \dfrac{16 \sin 54°}{\sin 72°}$ $\qquad = 13.610412933632638914904647953008$ $\qquad = 13.6 \text{ cm}$ (nearest mm)	**C**
8.	$\text{Area} = \dfrac{1}{2} \times 40 \times 50 \times \sin 100°$ $\qquad = 984.8077530$ $\qquad = 985 \text{ cm}^2$ (nearest cm^2)	**A**
9.	$\sin \gamma = \dfrac{1}{\sqrt{2}}$ Opposite $= 1$ and Hypotenuse $= \sqrt{2}$ So right isosceles triangle shown. $\sin \gamma = 45°$ 	**C**
10.	Join BD so D is south of B. $\angle DBC = 53°$ (angles on st line $\angle ABD = 40°$ (αt angles on $\parallel$ $\angle ABC = 40 + 53 = 93°$ 	**D**

11.	$\dfrac{\sin F}{56} = \dfrac{\sin 62°}{63}$ $(\sin F) = \dfrac{56 \times \sin 62°}{63}$ $\quad\quad = 0.7848423$ $\quad\quad = 51.706$ $\quad\quad = 52°$ (nearest degree) 	**B**
12.	$\angle BCM = 295 - 220 = 75°$ $BM^2 = 15.5^2 + 12.5^2 - 2 \times$ $\quad\quad = 296.2076$ $BM = \sqrt{296.2076}$ $\quad\quad = 17.21068331$ $\quad\quad = 17.2$ km 	**C**
13.	$\cos \theta = 0.8$ $\theta = \cos^{-1}(0.8)$ $\quad = 36.869$ $\quad = 37°$ (nearest degree) As cos is negative when $\theta > 90°$, this is the only solution for $0 \le \theta \le 180°$	**A**
14.	In $\triangle ABC$ $\tan 32° = \dfrac{BC}{25}$ $BC = 25 \tan 32°$ $\quad = 15.6$ cm In $\triangle BCD$ $\tan 28° = \dfrac{15.6}{BD}$ $BD = \dfrac{15.6}{\tan 28°}$ $\quad = 29.4$ cm	**D**

| 15. | In Δ PQS

$\sin 40° = \dfrac{25}{PQ}$

$PQ = \dfrac{25}{\sin 40°}$

$= 38.893$

In Δ PQR

$\angle PQR = 180 - (40 + 56)$
$= 84°$

$\dfrac{PR}{\sin 84°} = \dfrac{38.893}{\sin 56°}$

$PR = \dfrac{38.893 \times \sin 84°}{\sin 56°}$

$= 46.65655$
$= 46.7$ cm (nearest mm) | **D** |

School Name

Mathematics 2017

Multiple Choice Answer Sheet

Non-Right Triangle Trigonometry

Name _____

Completely fill the response oval representing the most correct answer.

1. A ◯ B ◯ C ◯ D ●
2. A ◯ B ● C ◯ D ◯
3. A ◯ B ◯ C ● D ◯
4. A ◯ B ◯ C ◯ D ●
5. A ● B ◯ C ◯ D ◯
6. A ◯ B ● C ◯ D ◯
7. A ◯ B ◯ C ● D ◯
8. A ● B ◯ C ◯ D ◯
9. A ◯ B ◯ C ● D ◯
10. A ◯ B ◯ C ◯ D ●
11. A ◯ B ● C ◯ D ◯
12. A ◯ B ◯ C ● D ◯
13. A ● B ◯ C ◯ D ◯
14. A ◯ B ◯ C ◯ D ●
15. A ◯ B ◯ C ◯ D ●