HIGHER

5.20 Exact trig values: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Write down the exact value of sin 30 degrees.

(Total for Question 1 is 1 mark)

2 Work out the exact value of tan 30 degrees. Give your answer in a simplified exact form.

(Total for Question 2 is 2 marks)

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3 The table shows some exact trigonometric values. One value is given for you. Complete the table, giving each missing value in its simplest exact form.

	30°	45°	60°
sin	1/2	(c)	(f)
cos	(a)	(d)	(g)
tan	(b)	(e)	(h)

(a) cos 30 **(1)**

(b) tan 30 **(1)**

(c) sin 45 **(1)**

(d) cos 45 **(1)**

(e) tan 45 **(1)**

(f) sin 60 **(1)**

(g) cos 60 **(1)**

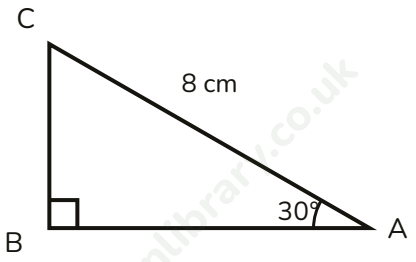
(h) tan 60 **(1)**

(Total for Question 3 is 8 marks)

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4 Triangle ABC has a right angle at B. Angle A = 30 degrees and AC = 8 cm. Calculate the length of BC. Give your answer as an exact value.

Diagram NOT accurately drawn



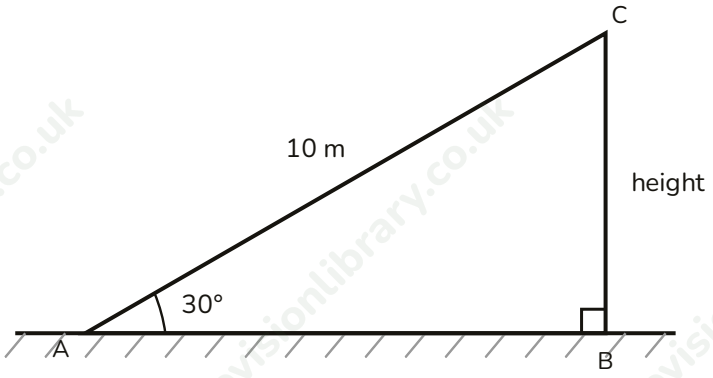
Not drawn accurately

(Total for Question 4 is 2 marks)

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5 A ramp is 10 m long and makes an angle of 30 degrees with the horizontal ground. Calculate the exact height of the top of the ramp above the ground.

Diagram NOT accurately drawn



(Total for Question 5 is 2 marks)

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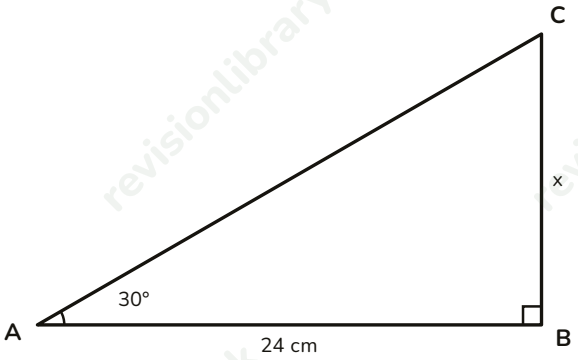
6 Write down the exact value of tan 30 degrees.

(Total for Question 6 is 1 mark)

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7 ABC is a right-angled triangle with the right angle at B. AB = 24 cm and angle BAC = 30 degrees. Work out the length BC. Give your answer in the form a $\sqrt{3}$ or as an integer, without using a calculator.

Diagram NOT accurately drawn



(Total for Question 7 is 3 marks)

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8 Solve, for $0 \leq x \leq 90$, $\cos x = \sqrt{2}/2$

(Total for Question 8 is 2 marks)

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9 Explain why tan 90 degrees is undefined.

(Total for Question 9 is 1 mark)

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10 Solve for θ, giving exact answers in degrees, in the interval $0 \leq \theta < 180$ degrees.

$\sin \theta = \sqrt{3}/2$

Solve $\sin \theta = \sqrt{3}/2$ for $0 \leq \theta < 180$ degrees. **(2)**

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(Total for Question 10 is 2 marks)

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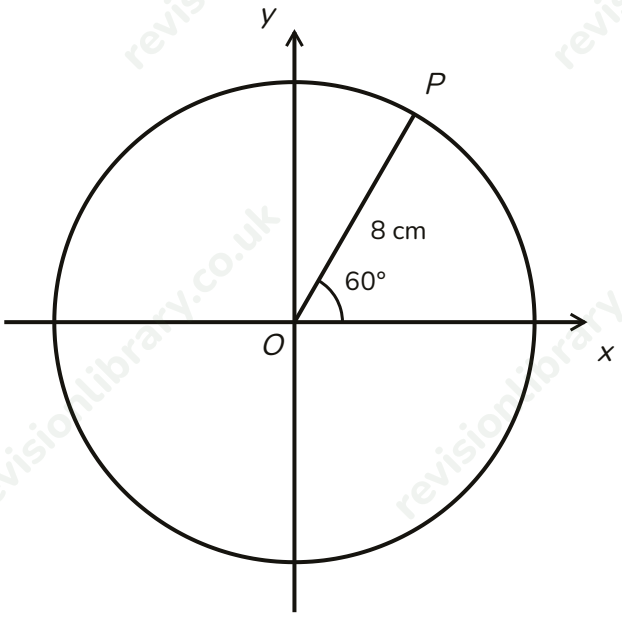
11 Show that sin 15 degrees = $(\sqrt{6} - \sqrt{2}) / 4$. You may use exact values for sin 30, cos 30, sin 45 and cos 45.

(Total for Question 11 is 3 marks)

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12 A point P lies on a circle with centre O at the origin and radius 8 cm. The line segment OP makes an angle of 60 degrees with the positive x-axis. Work out the exact coordinates of P, giving each coordinate in its simplest exact form.

Diagram NOT accurately drawn



(Total for Question 12 is 4 marks)

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13 Show that sin 18 degrees = $(\sqrt{5} - 1) / 4$.

You may use algebraic methods or known exact cosine values; show all steps clearly.

Derive sin 18 degrees = $(\sqrt{5} - 1) / 4$, showing working. **(8)**

(Total for Question 13 is 8 marks)

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14 Solve the equation $2\cos(\theta) = \sqrt{3}$ for $0 \leq \theta \leq 90$, giving an exact value of θ. Using your value of θ, work out the exact value of $4(\sin(\theta))^2 - 1$.

(Total for Question 14 is 5 marks)

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Mark scheme · 5.20 Exact trig values: Test Pack

Question 1

1/2 cao **B1**

Answer: 1/2

Question 2

use sin 30 and cos 30 or the known exact ratio tan 30 = $1/\sqrt{3}$ **M1**

$\sqrt{3}/3$ cao (rationalised form) **A1**

Answer: $\sqrt{3}/3$

Question 3

(a) $\sqrt{3}/2$ oe **B1**

(a) Answer: $\sqrt{3}/2$

(b) $\sqrt{3}/3$ oe, accept $1/\sqrt{3}$ **B1**

(b) Answer: $\sqrt{3}/3$

(c) $\sqrt{2}/2$ oe **B1**

(c) Answer: $\sqrt{2}/2$

(d) $\sqrt{2}/2$ oe **B1**

(d) Answer: $\sqrt{2}/2$

(e) 1 cao **B1**

(e) Answer: 1

(f) $\sqrt{3}/2$ oe **B1**

(f) Answer: $\sqrt{3}/2$

(g) 1/2 oe **B1**

(g) Answer: 1/2

(h) $\sqrt{3}$ cao **B1**

(h) Answer: $\sqrt{3}$

Question 4

BC = AC x sin(30) or equivalent correct trig equation **M1**

BC = 4 cm cao **A1**

Answer: BC = 4 cm

Question 5

height = 10 x sin(30) **M1**

height = 5 m cao **A1**

Answer: 5 m

Question 6

$\sqrt{3}/3$ oe **B1**

Answer: $\sqrt{3}/3$

Question 7

BC = 24 x tan 30 **M1**

tan 30 = $\sqrt{3}/3$ used **M1**

$8\sqrt{3}$ cm oe **A1**

Answer: $8\sqrt{3}$ cm

Question 8

recognise $\sqrt{2}/2$ as an exact cosine value **M1**

x = 45 cao **A1**

Answer: x = 45

Question 9

correct reference to tan θ = sin θ / cos θ and cos90 = 0, so the calculation would involve dividing by zero (oe: adjacent side has length 0) **B1**

Answer: tan90 is undefined because tan θ = sin θ / cos θ, and cos90 = 0, so the calculation would require dividing by zero.

Question 10

identify principal angle 60 degrees and use symmetry to find second solution 120 degrees **M1**

θ = 60 degrees and 120 degrees cao **A1**

Answer: θ = 60 degrees or 120 degrees

Question 11

use sine difference formula sin(45 - 30) = sin45 cos30 - cos45 sin30 or equivalent **M1**

substitute exact values: $(\sqrt{2}/2)(\sqrt{3}/2) - (\sqrt{2}/2)(1/2)$ leading to $(\sqrt{6} - \sqrt{2})/4$ **M1**

$(\sqrt{6} - \sqrt{2})/4$ cao, cso **A1**

Answer: $(\sqrt{6} - \sqrt{2}) / 4$

Question 12

sets up x-coordinate = 8 x cos60 **M1**

x = 4 cao **A1**

sets up y-coordinate = 8 x sin60, using sin60 = $\sqrt{3}/2$ **M1**

$y = 4\sqrt{3}$ cao **A1**

Answer: P = $(4, 4\sqrt{3})$

Question 13

use a suitable exact relation such as $\cos 36 = (\sqrt{5} + 1)/4$ or derive a polynomial for cos36 using double-angle or pentagon symmetry **M1**

use relationship $\sin 18 = \sqrt{(1 - \cos 36)/2}$ or equivalent identity **M1**

substitute $\cos 36 = (\sqrt{5} + 1)/4$ and simplify under the square root **M1**

simplify to $(\sqrt{5} - 1)/4$ as positive root (since sin18 is positive) **M1**

give algebraic justification for selecting the positive root (angle in first quadrant) **M1**

$\sin 18 = (\sqrt{5} - 1)/4$ cao, cso **A1**

alternative valid route: start from 5-fold angle equation for sine/cosine and factor to get the same value **M1**

final exact form shown clearly **A1**

Answer: sin 18 degrees = $(\sqrt{5} - 1) / 4$

Question 14

rearranges to $\cos(\theta) = \sqrt{3}/2$ **M1**

θ = 30 (degrees) cao **A1**

substitutes sin30 = 1/2 into the expression **M1**

squares and multiplies to reach 4 x 1/4 = 1 **M1**

0 cao **A1**

Answer: θ = 30 degrees; $4(\sin(\theta))^2 - 1 = 0$

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