

GCSE Higher maths worksheet

GCSE Higher | Years 10-11

Name _____ Class _____ Date _____

Score _____ / 24

Section A (questions 1-12): no calculator. Section B (questions 13-24): calculator allowed. Show full working; exact answers are expected unless a question asks you to round.

Example: $\sqrt{12} = \sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$. Look for the largest square factor.

Section A · Non-calculator

1. Evaluate $27^{2/3}$.

2. Evaluate $16^{-1/2}$.

3. Simplify $\sqrt{50} + \sqrt{18}$.

4. Rationalise the denominator of $6/\sqrt{3}$.

5. Factorise $2x^2 + 7x + 3$.

6. Solve $x^2 - 5x - 14 = 0$.

7. Write the recurring decimal $0.454545\dots$ as a fraction in its simplest form.

8. Expand and simplify $(x + 2)(x - 3)(x + 1)$.

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9. Solve the simultaneous equations $3x + 2y = 16$ and $5x - 2y = 0$.

Answer

10. Write $x^2 + 6x + 2$ in the form $(x + p)^2 + q$.

Answer

11. $f(x) = 2x - 1$ and $g(x) = x^2$. Find $fg(3)$.

Answer

12. $f(x) = (x + 4)/3$. Find $f^{-1}(x)$.

Answer

Section B • Calculator allowed

13. Solve $2x^2 - 3x - 7 = 0$. Give your answers to 2 decimal places.

Answer

14. In triangle ABC, angle A = 40° , angle B = 65° and $a = 8$ cm. Find b to 1 decimal place.

Answer

15. Two sides of a triangle are 7 cm and 9 cm and the angle between them is 50° . Find the third side to 1 decimal place.

Answer

16. Find the area of the same triangle (sides 7 cm and 9 cm, included angle 50°) to 1 decimal place.

Answer

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- 17.** A car worth £18 000 loses 12% of its value each year. Find its value after 4 years, to the nearest penny.

Answer

- 18.** y is directly proportional to x^2 . When $x = 3$, $y = 45$. Find y when $x = 5$.

Answer

- 19.** y is inversely proportional to x . When $x = 4$, $y = 12$. Find y when $x = 6$.

Answer

- 20.** Find the volume of a sphere with radius 4.5 cm. Give your answer to 3 significant figures.

Answer

- 21.** A rectangle is 12 cm by 5 cm, each measured to the nearest centimetre. Find the upper bound of its area.

Answer

- 22.** The angle at the centre of a circle is 124° . Find the angle at the circumference standing on the same arc.

Answer

- 23.** A bag holds 5 red and 3 blue counters. Two are taken without replacement. Find $P(\text{both red})$.

Answer

- 24.** Find the gradient of a line perpendicular to $y = 4x - 3$.

Answer

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Check each answer and its method. Equivalent forms are correct unless a question asks for a particular form or degree of accuracy.

Section A · Non-calculator

1. **9**

Take the cube root first: $\sqrt[3]{27} = 3$. Then square: $3^2 = 9$.

2. **$\frac{1}{4}$**

A negative index means a reciprocal: $1 \div 16^{1/2} = 1 \div 4 = \frac{1}{4}$.

3. **$8\sqrt{2}$**

$\sqrt{50} = \sqrt{25 \times 2} = 5\sqrt{2}$ and $\sqrt{18} = \sqrt{9 \times 2} = 3\sqrt{2}$. So $5\sqrt{2} + 3\sqrt{2} = 8\sqrt{2}$.

4. **$2\sqrt{3}$**

Multiply the top and bottom by $\sqrt{3}$: $6\sqrt{3}/3 = 2\sqrt{3}$.

5. **$(2x + 1)(x + 3)$**

Find two numbers that multiply to $2 \times 3 = 6$ and add to 7: 6 and 1. $2x^2 + 6x + x + 3 = 2x(x + 3) + 1(x + 3)$.

6. **$x = 7$ or $x = -2$**

Factorise: $(x - 7)(x + 2) = 0$, so $x = 7$ or $x = -2$.

7. **$\frac{5}{11}$**

Let $n = 0.4545\dots$, so $100n = 45.4545\dots$. Subtracting gives $99n = 45$, so $n = 45/99 = 5/11$.

8. **$x^3 - 7x - 6$**

$(x + 2)(x - 3) = x^2 - x - 6$. Multiply by $(x + 1)$: $x^3 + x^2 - x^2 - x - 6x - 6 = x^3 - 7x - 6$.

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9. $x = 2, y = 5$

Add the equations to remove y : $8x = 16$, so $x = 2$. Then $6 + 2y = 16$, so $y = 5$.

10. $(x + 3)^2 - 7$

Halve the coefficient of x : $(x + 3)^2 = x^2 + 6x + 9$. Then $2 - 9 = -7$.

11. 17

Work from the inside: $g(3) = 9$. Then $f(9) = 2 \times 9 - 1 = 17$.

12. $f^{-1}(x) = 3x - 4$

Write $y = (x + 4)/3$ and rearrange: $3y = x + 4$, so $x = 3y - 4$. Swap the letters: $f^{-1}(x) = 3x - 4$.

Section B · Calculator allowed

13. $x = 2.77$ or $x = -1.27$

Quadratic formula: $x = (3 \pm \sqrt{(9 + 56)})/4 = (3 \pm \sqrt{65})/4$, so $x = 2.765...$ or $-1.265...$

14. 11.3 cm

Sine rule: $b = a \sin B \div \sin A = 8 \times \sin 65^\circ \div \sin 40^\circ = 11.27... \text{ cm}$.

15. 7.0 cm

Cosine rule: $c^2 = 7^2 + 9^2 - 2 \times 7 \times 9 \times \cos 50^\circ = 49.00...$, so $c = 7.00... \text{ cm}$.

16. 24.1 cm²

Area = $\frac{1}{2}ab \sin C = \frac{1}{2} \times 7 \times 9 \times \sin 50^\circ = 24.13... \text{ cm}^2$.

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17. £10 794.52

Use the multiplier 0.88 four times: $18\,000 \times 0.88^4 = £10\,794.516\dots$

18. 125

$y = kx^2$, so $45 = 9k$ and $k = 5$. When $x = 5$: $y = 5 \times 25 = 125$.

19. 8

$y = k/x$, so $k = 4 \times 12 = 48$. When $x = 6$: $y = 48 \div 6 = 8$.

20. 382 cm³

$V = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \pi \times 4.5^3 = 381.7\dots \text{ cm}^3$, which is 382 cm³ to 3 s.f.

21. 68.75 cm²

Upper bounds are 12.5 cm and 5.5 cm, so the maximum area is $12.5 \times 5.5 = 68.75 \text{ cm}^2$.

22. 62°

The angle at the centre is twice the angle at the circumference: $124^\circ \div 2 = 62^\circ$.

23. 5/14

$P = \frac{5}{8} \times \frac{4}{7} = \frac{20}{56} = \frac{5}{14}$.

24. -1/4

Perpendicular gradients multiply to -1 , so $m = -1 \div 4 = -1/4$.
