Year 11 maths worksheet

Year 11 | GCSE Higher

Name _____ Class _____ Date _____ Score _____ / 24

Non-calculator. Show your working in the space and write each answer in the box. Give exact answers where a question asks for them.

Example: $8^{2/3} = 4$. Take the cube root first ($\sqrt[3]{8} = 2$), then square it ($2^2 = 4$).

Section A · Number

1. Work out $27^{2/3}$.

Answer

2. Work out $16^{-1/2}$.

Answer

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

Answer

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

Answer

5. Write the recurring decimal 0.363636... as a fraction in its simplest form.

Answer

6. A length l is 8.4 cm, correct to 1 decimal place. Write the error interval for l.

Answer

7. £5000 is invested at 2% compound interest per year. What is it worth after 2 years?

Answer

8. y is inversely proportional to x. When x = 4, y = 15. Find y when x = 10.

Answer

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Section B · Algebra

9. Solve $x^2 + 2x - 15 = 0$.

Answer

10. Solve the simultaneous equations $3x + 2y = 16$ and $x - y = 2$.

Answer

11. Solve $2x^2 - 7x + 3 = 0$.

Answer

12. Solve $-3 < 2x + 1 \leq 9$.

Answer

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

Answer

14. $f(x) = 3x - 2$ and $g(x) = x^2$. Work out $fg(2)$.

Answer

15. $f(x) = (x + 5)/2$. Find the inverse function $f^{-1}(x)$.

Answer

16. Write $x^2 + 6x + 11$ in the form $(x + a)^2 + b$. Then give the turning point of $y = x^2 + 6x + 11$.

Answer

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Section C · Geometry, probability and vectors

17. Find the equation of the line parallel to $y = 3x - 1$ that passes through (2, 9).

Answer

18. Work out the exact value of sin 30° + cos 60°.

Answer

19. Two mathematically similar cylinders have heights 4 cm and 12 cm. The smaller one has volume 20 cm³. Find the volume of the larger one.

Answer

20. In a circle, an arc subtends an angle of 136° at the centre. Find the angle it subtends at the circumference.

Answer

21. A sector has radius 6 cm and angle 60°. Find its area. Give your answer in terms of π.

Answer

22. A bag has 5 red and 3 blue counters. Two counters are taken without replacement. Find P(both red).

Answer

23. $\mathbf{a} = (3, -2)$ and $\mathbf{b} = (-1, 4)$ are column vectors. Work out $2\mathbf{a} + \mathbf{b}$.

Answer

24. A triangle has sides 5 cm and 8 cm with an angle of 60° between them. Use the cosine rule to find the third side.

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 · Number

1. **9**

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

2. **1/4**

The negative power means a reciprocal and the power ½ means a square root: $1 \div \sqrt{16} = 1/4$.

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

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

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

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

5. **4/11**

Let $x = 0.3636\ldots$, so $100x = 36.3636\ldots$. Subtract: $99x = 36$, so $x = 36/99 = 4/11$.

6. **$8.35 \leq l < 8.45$**

Half of 0.1 is 0.05. The lower bound is $8.4 - 0.05$ and the upper bound is $8.4 + 0.05$.

7. **£5202**

Multiply by 1.02 each year: $5000 \times 1.02 = 5100$, then $5100 \times 1.02 = 5202$.

8. **$y = 6$**

$y = k/x$, so $k = 4 \times 15 = 60$. When $x = 10$, $y = 60 \div 10 = 6$.

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Section B · Algebra

9. **$x = 3$ or $x = -5$**

Factorise: $(x + 5)(x - 3) = 0$, so $x = -5$ or $x = 3$.

10. **$x = 4$, $y = 2$**

Multiply the second equation by 2: $2x - 2y = 4$. Add it to the first: $5x = 20$, so $x = 4$. Then $y = x - 2 = 2$.

11. **$x = 1/2$ or $x = 3$**

Factorise: $(2x - 1)(x - 3) = 0$, so $2x = 1$ or $x = 3$.

12. **$-2 < x \leq 4$**

Subtract 1 from each part: $-4 < 2x \leq 8$. Divide each part by 2: $-2 < x \leq 4$.

13. **$x^3 + 2x^2 - 5x - 6$**

$(x + 3)(x - 2) = x^2 + x - 6$. Then $(x^2 + x - 6)(x + 1) = x^3 + x^2 + x^2 + x - 6x - 6 = x^3 + 2x^2 - 5x - 6$.

14. **10**

Work out g first: $g(2) = 2^2 = 4$. Then $f(4) = 3 \times 4 - 2 = 10$.

15. **$f^{-1}(x) = 2x - 5$**

Write $y = (x + 5)/2$ and rearrange: $2y = x + 5$, so $x = 2y - 5$. Swap the letters: $f^{-1}(x) = 2x - 5$.

16. **$(x + 3)^2 + 2$; turning point $(-3, 2)$**

$(x + 3)^2 = x^2 + 6x + 9$, so $x^2 + 6x + 11 = (x + 3)^2 + 2$. The minimum is 2, when $x = -3$.

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Section C · Geometry, probability and vectors

17. **y = 3x + 3**

Parallel lines have the same gradient, 3. Substitute (2, 9) into y = 3x + c: 9 = 6 + c, so c = 3.

18. **1**

sin 30° = 1/2 and cos 60° = 1/2. 1/2 + 1/2 = 1.

19. **540 cm³**

The length scale factor is 12 ÷ 4 = 3, so the volume scale factor is $3^3 = 27$. 20 × 27 = 540 cm³.

20. **68°**

The angle at the centre is twice the angle at the circumference: 136 ÷ 2 = 68°.

21. **6π cm²**

Area = (60/360) × π × 6^2 = 1/6 × 36π = 6π cm².

22. **5/14**

5/8 × 4/7 = 20/56 = 5/14.

23. **(5, 0)**

2a = (6, −4). Add b: (6 + −1, −4 + 4) = (5, 0).

24. **7 cm**

$c^2 = 5^2 + 8^2 - 2 \times 5 \times 8 \times \cos 60° = 25 + 64 - 80 \times 1/2 = 49$, so c = 7 cm.