1	2	3	4	5	6	7	8	9	10	11	12	Sum

Mathematics

INSTRUCTIONS TO CANDIDATES

- *Maximum marks: 40*
- *Working time: 60 minutes*
- *Number of questions: 12*
- *Number of pages: 6*
- *Don't use a calculator, please!*
- *You are advised to show all working where possible. Where an answer is wrong some marks may be given for correct method provided this is shown by written working. For the solution of can use also clean pages of paper. Please, don't forget to mark the number of the question.*

- *Trigonometric values:* $\sin\frac{\pi}{6}=\cos\frac{\pi}{3}=\frac{1}{2}$ $\sin\frac{\pi}{3}=\cos\frac{\pi}{6}=\frac{\sqrt{3}}{2}$ $\sin\frac{\pi}{4}=\cos\frac{\pi}{4}=\frac{\sqrt{2}}{2}$ $\tan\frac{\pi}{3}=\cot\frac{\pi}{6}=\sqrt{3}$

- *Sine rule:* $\frac{a}{\sin\hat{A}}=\frac{b}{\sin\hat{B}}=\frac{c}{\sin\hat{C}}$

- *Cosine rule:* $a^2=b^2+c^2-2bc\cos\hat{A}$

1. A student can complete a maths question in five minutes and a biology question in twelve minutes. A certain day's maths and biology homework consists of eleven questions altogether and takes an hour-and-a-half. Find how many questions were set in each subject.

3 m

Answer: .....

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2. The hypotenuse of a right-angled triangle measures 17 cm. The shortest side is 7 cm shorter than the middle side. Find the perimeter of the right-angled triangle.

3 m

Answer: .....

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3. Solve the inequality: $(x+1)^2 \leq 6x^2 + x + 1, \quad x \in R$.

3 m

Answer: .....

4. Find the values of a and b for such that $14-4\sqrt{6}=\left(\sqrt{a}-2\sqrt{b}\right)^2$.

3 m

Answer: .....

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5. Six lines are drawn, no two of which are parallel. If no more than two of the lines pass through any one point, find the number of triangles formed.

3 m

Answer: .....

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6. Given that $f(x)=\cos\frac{x}{3}$ and $g(x)=2x^2-1$. Find expressions for these composite functions:

3 m

(a) $(g\circ f)(x)$
(b) $(f\circ g)(x)$
(c) $(g\circ g)(x)$

Answers: (a) ..... (b) ..... (c) .....

7. The sides of a triangle are in the ratio 2 : 3 : 4. Find the cosine of the largest angle of this triangle.

3 m

Answer: .....

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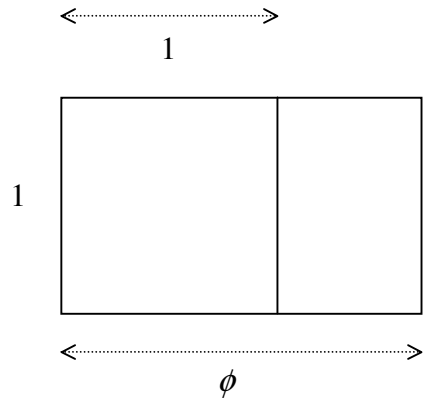
8. A golden rectangle is such that when a square with sides equal to the width is removed, the remaining rectangle has sides in the same ratio as in the original rectangle. Find the exact value of ϕ.

3 m

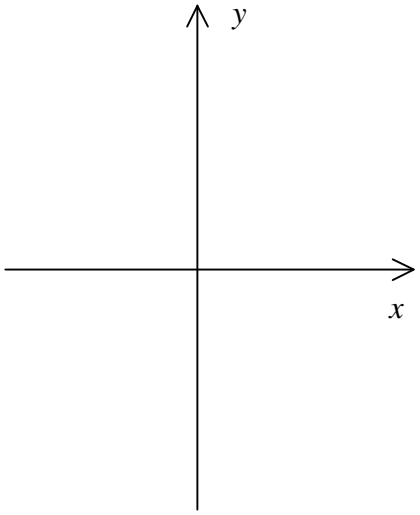


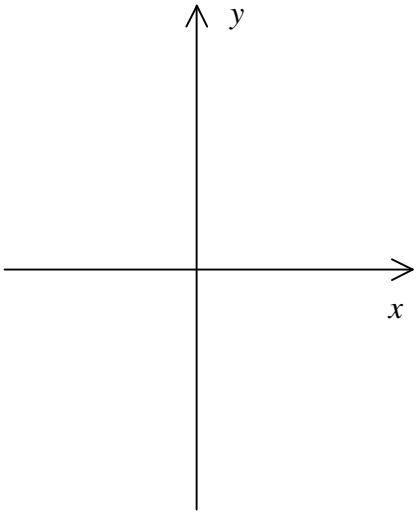
Answer: .....

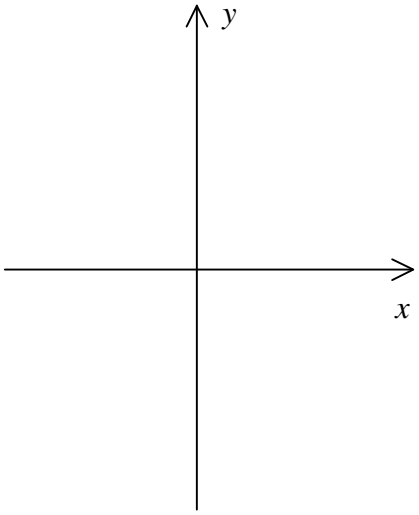
9. Sketch these graphs, each on a different diagram.

3 m

(a) $y = \sqrt{1-x}$ (b) $y = 1-\sqrt{x}$ (c) $y = \dfrac{1}{\sqrt{x}}$







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10. Find the solution of the equation $\sin^2(3x) = \dfrac{1}{2}$, where $100° < x < 200°$.

4 m

Answer: .....

11. Calculate the possible values of k if the equation $(k+1)x^2 + kx + k + 1 = 0$ has only one root.

4 m

Answer: .....

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12. Given that $f(x) = |x-2| + \dfrac{|x+1|}{x+1} - 3$

5 m

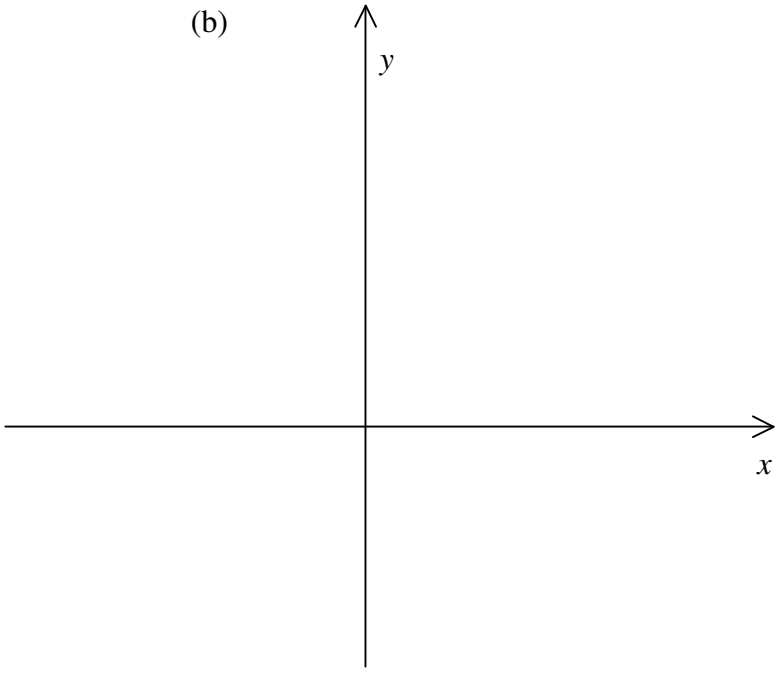
(a) Find the domain of $f(x)$.

(b) Sketch the graph of $f(x)$.

(c) Solve the inequality $f(x) < 0$.

Answers (a) .....

(b)



(c) .....
