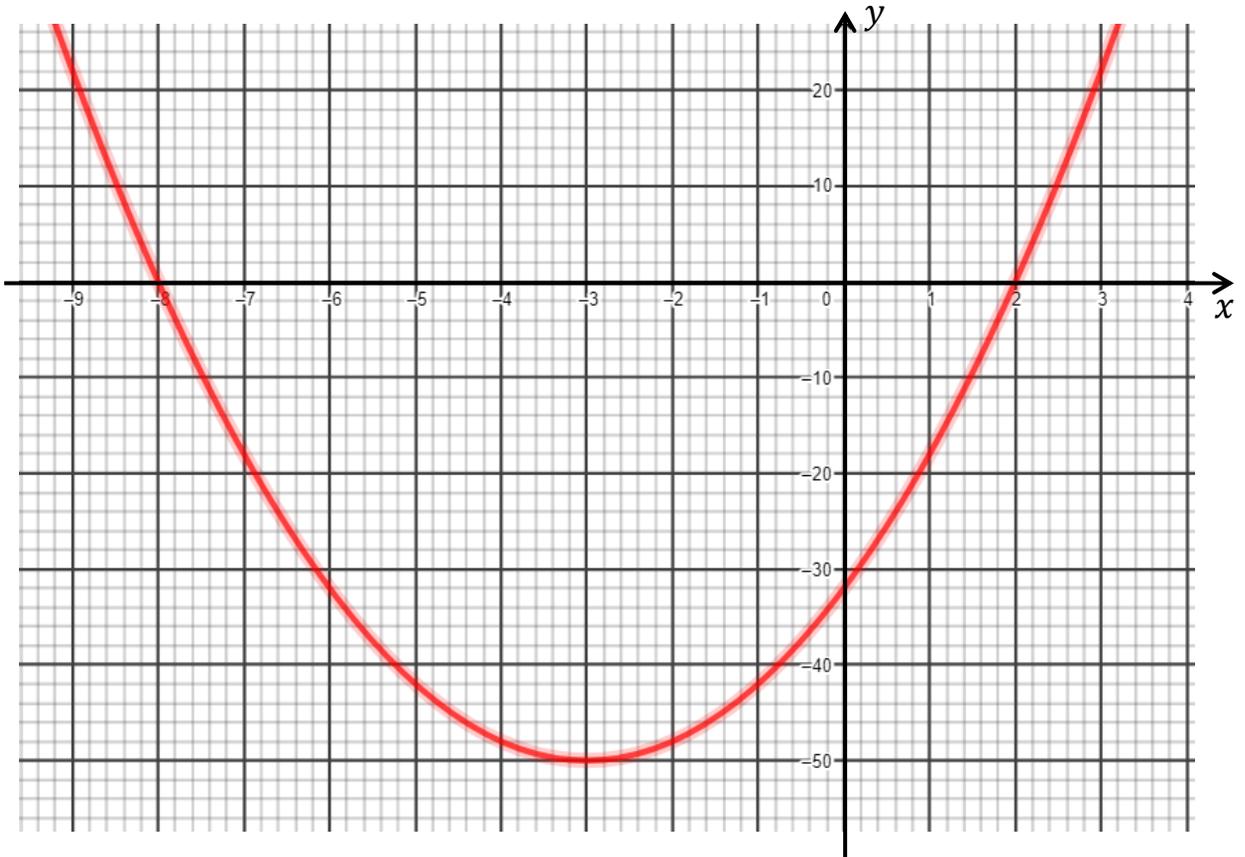# Sample Exam past paper

## Duration: 2 hours (approximately)

1. Write down the equation of the quadratic curve depicted on the grid below in the form
$y = a(x + b)^2 + c$ where $a \in \mathbb{R}$, $b \in \mathbb{R}$, $c \in \mathbb{R}$.

2. A solid cuboid has a volume of $40\ cm^3$. The cuboid has a total surface area of $100\ cm^2$. One edge of the cuboid has length $2\ cm$.

Find the length of the diagonal AG of the cuboid by forming and solving relevant equations. Give your answer correct to 3 significant figures.
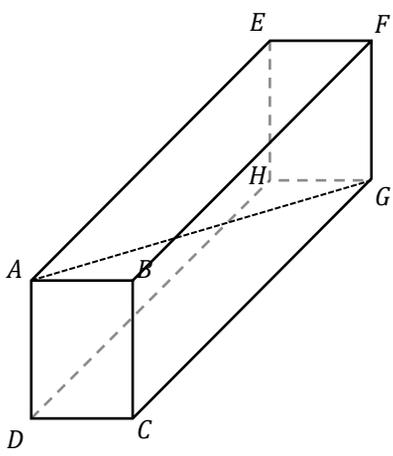
3. a) Write the following expression in the form $\frac{a-b\sqrt{c}}{d}$ where a, b, c and d are integers to be found.

$$\frac{\dfrac{6}{\sqrt{50}} + 2\sqrt{48}}{\sqrt{48} + \dfrac{4}{\sqrt{50}}} =$$

4. Simplify the following algebraic fractions:

a) $\dfrac{6x^2 - 7x - 3}{9x^2 + 6x + 1} =$

b) $\dfrac{2x^3 + 5x^2 - 2x - 5}{x^2 - 16} \div \dfrac{4x^2 - 25}{2x - 8} =$

c) $\dfrac{x}{x - y} \div \dfrac{x}{y - x} =$

5. The first term of an arithmetic series is a and the common difference is d. The 18th term of the series is 25 and the 21st term of the series is $32 \frac{1}{2}$.

    a) Use this information to write down two equations for a and d.

    b) Show that $a = -17.5$ and find the value of d.

The sum of the first n terms of the series is 2750

    c) Show that n is given $n^2 - 15n = 55 \times 40$
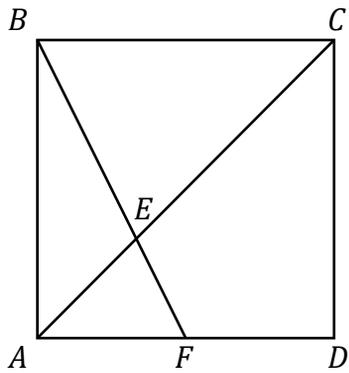
    d) Hence find the value of n.

6. The sum of the first two terms of an arithmetic series is 18 and the sum of the first four terms is 52. Find the sum of the first eight terms.

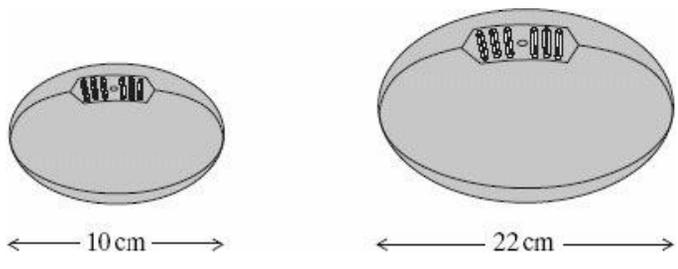7. Find the sum of the series $26 + 22 + 18 + \cdots - 3602$

8. ABCD is a square where F is the mid-point of AD.

Write down the ratio of AC and AE.

Give reasons for all your working.

9. A child's rugby ball is 10 cm long and has a volume of $200\ cm^3$. It is similar in shape to a full-size rugby ball. A full-size rugby ball is $22\ cm$ long. Find the volume of the full-size ball.
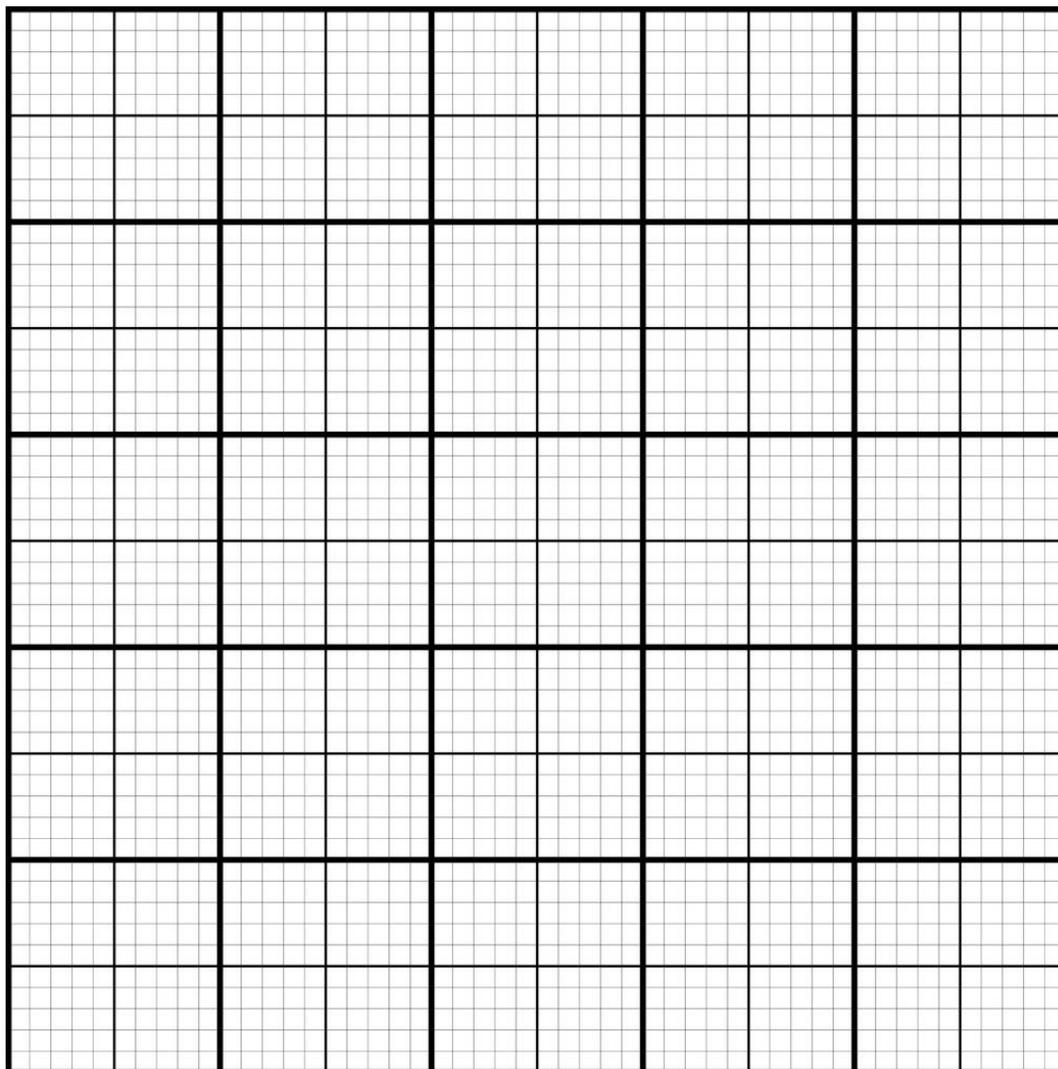

10 cm   22 cm

10. Two functions $f(x)$ and $g(x)$ are defined such that $f(x) = 24 + 3x$ and $g(x) = x^2 - 9x$.

a) Find the composite function $fg(x)$.

b) State the Domain and the Range of $fg(x)$.

c) Hence, sketch the graph of $fg(x)$ on the grid below indicating all the points of intersections with both axis and the minimum/maximum point.

d) Using your sketch and by drawing any relevant straight lines, find the gradient of $fg(x)$ at $x = 1$
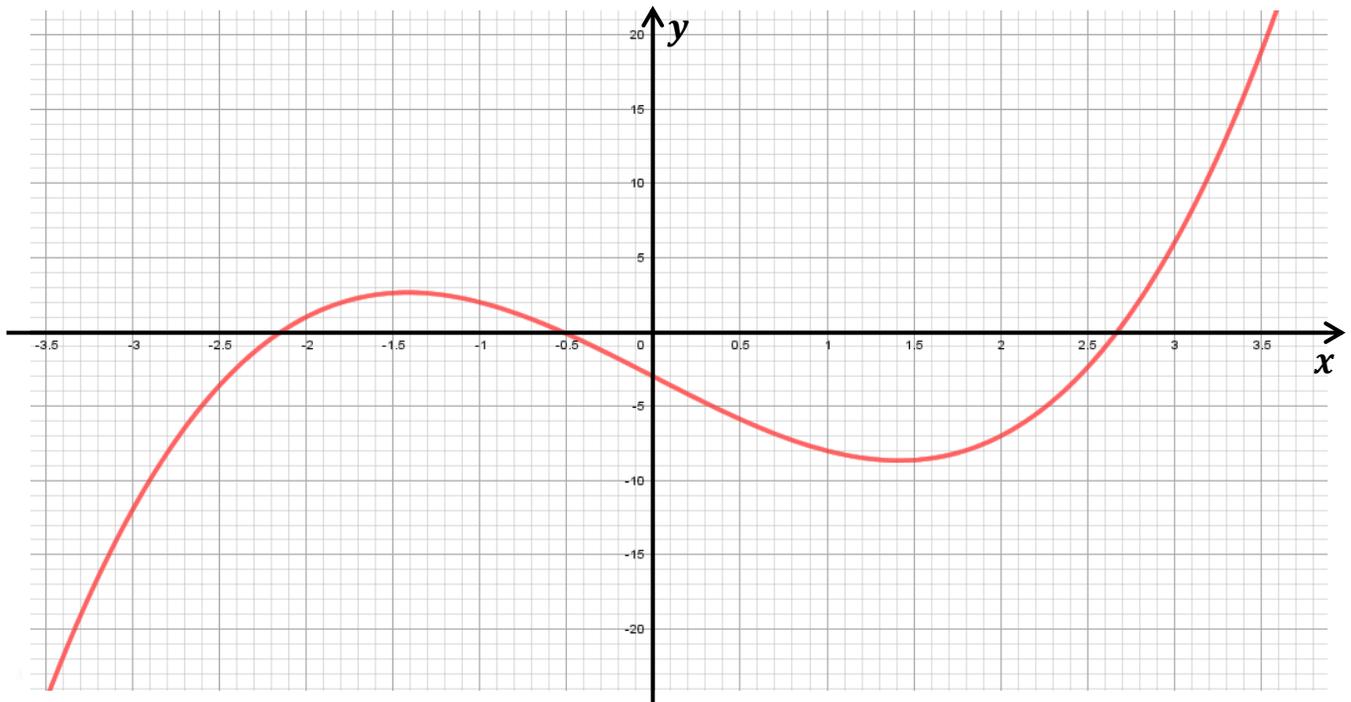
11. Given the curve $2x^2 - 4x - 15$ find the equations of the straight lines that have to be drawn to solve the following equations

a) $2x^2 - 4x - 15 = -2x + 12$

b) $2x^2 - 7x - 12 = 0$

c) $4x^2 - 12x - 6 = 0$

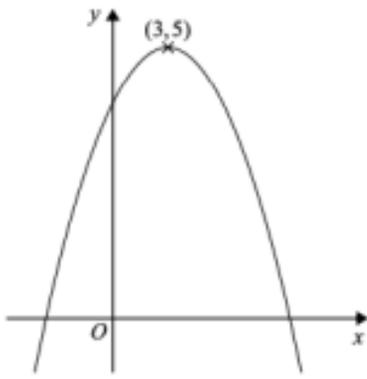12. The graph of $y = x^3 - 6x - 3$ is given below.

Use the graph to solve the following equations, giving your answers correct to 1 decimal place, where appropriate:

a) $x^3 - 6x - 3 = 0$

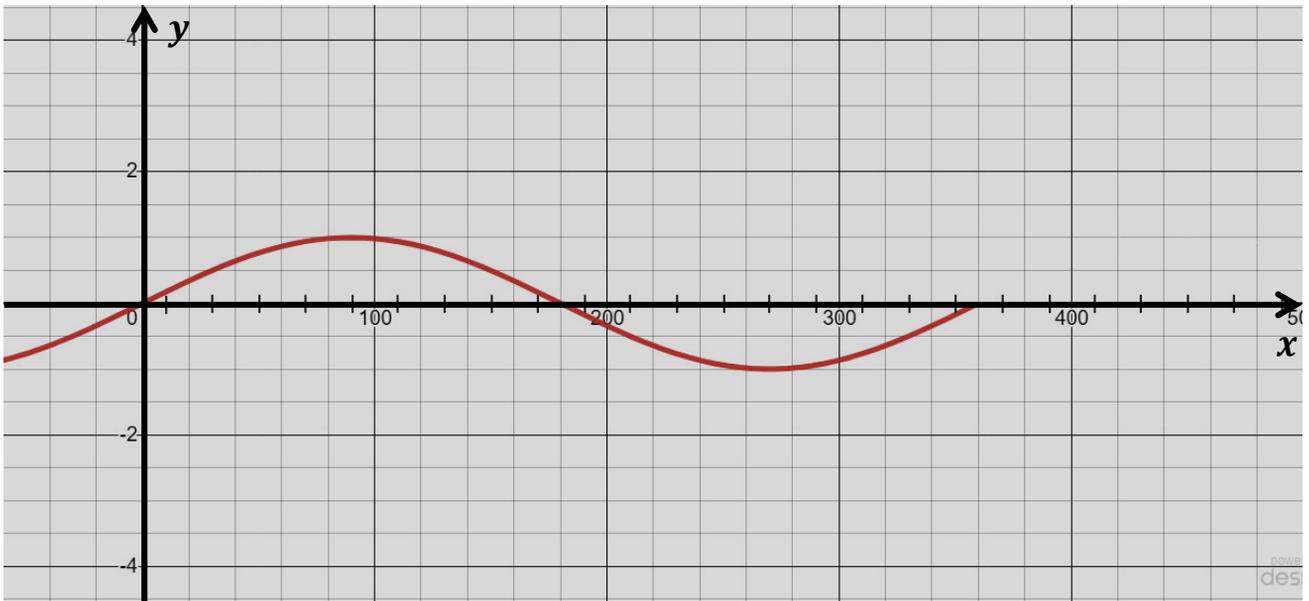**b)** $x^3 - 6x - 3 = 3x - 5$

c) $2x^3 - 10x = 0$

(3,5)

13 a) The diagram shows part of the curve with equation
$y = f(x)$ The coordinates of the maximum point of
the curve are (3,5).

Write down the coordinates of the maximum point of
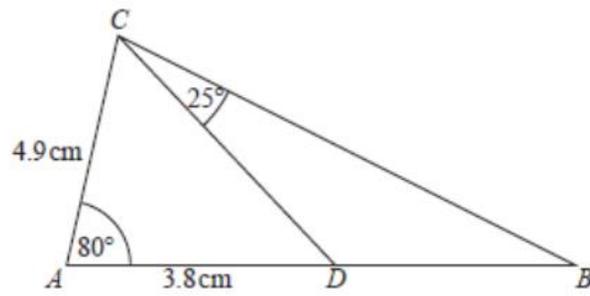the curve with equation $y = f(3x)$

(,   )

b) Here is the graph of $f(x) = \sin(x)$ for $0 \le x \le 360°$

a) On the same grid, sketch the graph of $g(x) = \frac{3}{2}\sin\left(\frac{x}{2}\right) + 3$ for $0 \le x \le 360°$

b) Hence write down the coordinates of the maximum point A on the graph of $g(x)$.

c) The exact value of $\sin 30° = \frac{1}{2}$
Write down the exact value of $\sin 150°$ and $\sin 210°$.

$$\sin(150°) = \underline{\quad\quad}$$

$$\sin(210°) = \underline{\quad\quad}$$

14.

ABC is a triangle.

D is a point on AB.

Work out the area of triangle *BCD*.

Give your answer correct to 3 significant figures.

15. A ship's captain is plotting a course for the next voyage.

He knows that he has to sail from pot D to port E on a bearing of $067°$ for a distance of $800\ Km$ and from there to port F on a bearing of $123°$.

a) Draw a diagram below to show the course of the ship.

b) Calculate the size of angle $D\hat{E}F$.

c) New instructions come through which inform the captain that he has to sail directly from port D to port F, a distance of $1750\ Km$.

Calculate the bearing on which the ship should sail in order to carry out these instructions. Give the bearing to the nearest degree.

16. a) Convert 4.5×10^3 m² into cm².

b) An object has density of 16 g/cm^3 and a volume of 9 cm³. What is the mass of the object?

c) This is the formula for pressure:

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

A cuboid with a base area of 65 cm² applies a force of 135 N to the floor.
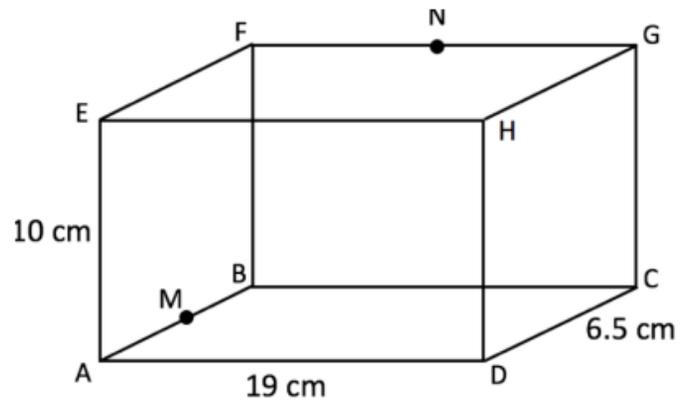
What is the pressure that the floor is under in N/cm²?

d) The density of the air around us is 1.3 kg/m³.

What is the volume of a balloon that can hold 7.23 g of air?

17. ABCDEFGH is a cuboid as shown on the diagram.

Find:

a) The length of FM

b) The length of DF

c) The length of DM
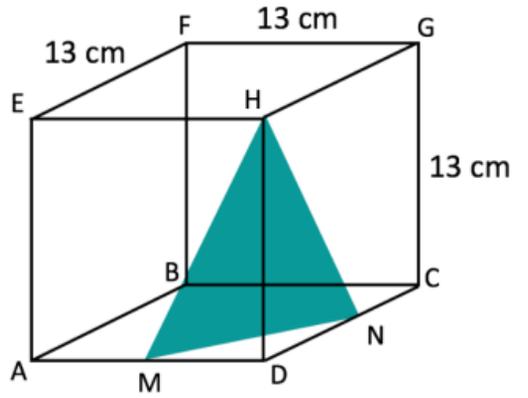
d) The size of angle $F\hat{D}M$

M and N are the mid-points of AB and FG respectively.

18. CHALLENGE BONUS QUESTION:

ABCDEFGH is a cube as shown on the diagram.

Find:

a) The length of MN

b) The length of HM

c) The size of angle $M\hat{H}N$

M and N are the mid-points of AD and CD respectively.

19. Prove algebraically that the difference between the squares of any two consecutive numbers is always an odd number

20. Prove algebraically that the sum of the squares of any three consecutive odd numbers always leaves a remainder of 11 when divided by 12.

21. A square based pyramid's volume is the same of that of a cone, and the radius of the base of the cone is the same length as the sides of the square on the base of the first pyramid. If the height of the pyramid is x and the height of the cone is y, what is the value of $\frac{x}{y}$?

What does this mean practically?

22. ABCD is a trapezium. The following ratios are given as:

DC : AB = 2 : 1

AM : MD = 1 : 1

BM : MN = 1 : 1

Show that CDN is a straight line. You must justify fully your answer.