Name: _____

Maths Genie Stage 12

Test A

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**
- **Calculators may be used.**

Information

- The marks for each question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end

1 Solve $3x^2 - 8x - 13 = 0$

Give your solutions correct to 3 significant figures.

$a = 3 \quad b = -8 \quad c = -13$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(-13)}}{2(3)}$$

$x = 3.81$ or $x = -1.14$

(Total for Question 1 is 3 marks)

by factorising

2 Solve $5x^2 - 11x - 12 = 0$

$5 \times 12 = 60$

1	60
2	30
3	20
4	15
5	12
6	10

$(5x + 4)(x - \frac{15}{5}) = 0$

$(5x + 4)(x - 3) = 0$

$x = -\frac{4}{5} \quad x = 3$

$x = \frac{-4}{5}$ or $x = 3$

(Total for Question 2 is 3 marks)

3 Charlie invests £3500 for 3 years in a savings account.
She gets 2.5% per annum compound interest in the first year, then x% for 2 years.

Charlie has £3674.12 at the end of 3 years, work out the value of x .

$3500 \times 1.025 \times y^2 = 3674.12$

$y^2 = \frac{3674.12}{3500 \times 1.025}$

$y^2 = 1.02414...$

$y = \sqrt{1.02414...}$

$y = 1.012$

Multiplier of 1.012

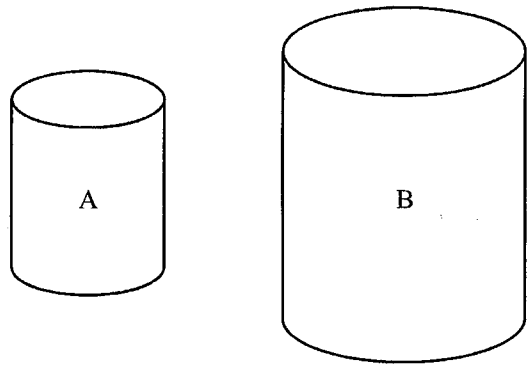
$(1.012 - 1) \times 100$

$= 1.2\%$

1.2 %

(Total for Question 3 is 3 marks)

4



The two cylinders, *A* and *B*, are mathematically similar.
Cylinder *A* has a height of 4 cm.
Cylinder *B* has a height of 6 cm.

The volume of cylinder *A* is 100π cm^3

Calculate the volume of cylinder B.
Give your answer correct to 3 significant figures.

scale factor for lengths $= \frac{6}{4} = \frac{3}{2}$

s.f for volume $= \left(\frac{3}{2}\right)^3 = \frac{27}{8}$

$100\pi \times \frac{27}{8} = 1060 \text{ cm}^3$

1060 cm^3

(Total for Question 4 is 3 marks)

5 y is inversely proportional to the cube of x

When $y = 300$, $x = 0.4$

Find the value of y when $x = 0.8$

$$y \propto \frac{1}{x^3}$$

$$y = \frac{k}{x^3}$$

$$300 = \frac{k}{0.4^3}$$

$$k = 300 \times 0.4^3$$

$$= 19.2$$

$$y = \frac{19.2}{x^3}$$

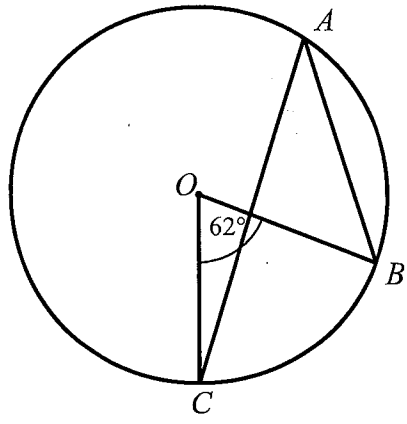
$$y = \frac{19.2}{(0.8)^3}$$

$$= 37.5$$

$y =$ 37.5

(Total for Question 5 is 3 marks)

6



A, B, C and D are points on the circumference of a circle.

Angle $BOC = 62°$

$$\frac{62}{2} = 31°$$

(i) Find the size of angle BAC.

31 °

(ii) Give a reason for your answer.

The angle at the centre is twice the angle at the circumference

(Total for Question 6 is 2 marks)

7 There are 5 starters, 8 main courses and 3 desserts in a restaurant.

Work out the total number of ways of choosing a starter, a main course and a dessert.

$5 \times 8 \times 3$

120

(Total for Question 7 is 2 marks)

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8 Here are the first 5 terms of a quadratic sequence.

12 6 -4 -18 -36

Find an expression, in terms of n, for the nth term of this sequence.

$2a \rightarrow 12 \quad 6 \quad -4 \quad -18$

$3a+b \rightarrow -6 \quad -10 \quad -14$

$a+b+c \rightarrow -4 \quad -4$

$2a = -4$

$a = -2$

$3a + b = -6$

$3(-2) + b = -6$

$-6 = b = -6$

$b = 0$

$a + b + c = 12$

$-2 + 0 + c = 12$

$c = 14$

$-2n^2 + 14$

(Total for Question 8 is 4 marks)

9 Given that $f(x) = 3x - 2$ and $g(x) = 5x + 1$

(a) Find gf(3)

$f(3) = 3(3) - 2$

$= 9 - 2$

$= 7$

$g(7) = 5(7) + 1$

$= 35 + 1 = 36$

36

(2)

(b) Work out an expression for $f^{-1}(x)$

$f(x) = 3x - 2$

$y = 3x - 2$

$y + 2 = 3x$

$\frac{y + 2}{3} = x$

$f^{-1}(x) = \frac{x + 2}{3}$

$f^{-1}(x) = \frac{x+2}{3}$

(2)

(Total for Question 9 is 4 marks)

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10 Using $x_{n+1} = \frac{6}{x_n^2 + 4}$

With $x_0 = 1$

Find the values of x_1, x_2 and x_3.

$x_1 = \frac{6}{(1)^2 + 4} = 1.2$

$x_2 = \frac{6}{(Ans)^2 + 4} = \frac{75}{68}$

$x_3 = 1.150201007$

$x_1 =$ 1.2

$x_2 =$ 1.102941176

$x_3 =$ 1.150201007

(Total for Question 10 is 3 marks)