Name: _____

Maths Genie Stage 12

Test B

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 David has 25 different cards.
David is going to give one card to Dean and one card to Edwin.

How many different ways are there of doing this?

$25 \times 24 = 600$

600

(Total for Question 1 is 2 marks)

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2 Solve $5x^2 + x - 13 = 0$

Give your solutions correct to 3 significant figures.

$a = 5 \quad b = 1 \quad c = -13$

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(5)(-13)}}{2(5)}$$

$x = 1.52$ or $x = -1.72$

(Total for Question 2 is 3 marks)

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3 The number of rabbits in a field is increasing by x% each year.

The population is expected to double in 7 years, work out the value of x.
Give your answer to 1 decimal place.

$1 \times y^7 = 2$

$y^7 = 2$

$y = \sqrt[7]{2}$

$= 1.104$

$(1.104 - 1) \times 100$

$= 10.4\%$

10.4 %

(Total for Question 3 is 3 marks)

4 a is directly proportional to b

When $a = 9$, $b = 45$

Find the value of b when $a = 6.5$

$a \propto b$

$a = kb$

$9 = k(45)$

$k = \frac{1}{5}$

$a = \frac{1}{5}b$

$6.5 = \frac{1}{5}b$

$b = 32.5$

$b =$ 32.5

(Total for Question 4 is 3 marks)

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

5 7 11 17 25

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

$an^2 + bn + c$

$a + b + c \longrightarrow$ 5 7 11 17

$3a + b \longrightarrow$ 2 4 6

$2a \longrightarrow$ 2 2

$2a = 2$

$a = 1$

$3a + b = 2$

$3(1) + b = 2$

$3 + b = 2$

$b = -1$

$a + b + c = 5$

$1 - 1 + c = 5$

$c = 5$

$n^2 - n + 5$

~~$n^2 + n + 3$~~

(Total for Question 5 is 4 marks)

6 Given that $f(x) = x^2 - 5$ and $g(x) = 2x + 3$

(a) Work out an expression for $g^{-1}(x)$

$y = 2x + 3$

$y - 3 = 2x$

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

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

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

(2)

(b) Work out an expression for $fg(x)$
Give your answer in its simplest form.

$fg(x) = (2x + 3)^2 - 5$

$= (2x + 3)(2x + 3) - 5$

$= 4x^2 + 6x + 6x + 9 - 5$

$= 4x^2 + 12x + 4$

$4x^2 + 12x + 4$

(2)

(Total for Question 6 is 4 marks)

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7 The number of people living in a town t years from now is P_t where

$P_0 = 62000$

$P_{t+1} = 1.04(P_t - 1500)$

Work out the number of people in the town 3 years from now.

$P_1 = 1.04(62000 - 1500) = 62920$

$P_2 = 1.04(\text{Ans} - 1500) = 63877$

$P_3 = 1.04(\text{Ans} - 1500) = 64872$

64872

(Total for Question 7 is 3 marks)

8 Factorise $3x^2 - 2x - 8$

$3 \times 8 = 24$

1	24
2	12
3	8
4	6

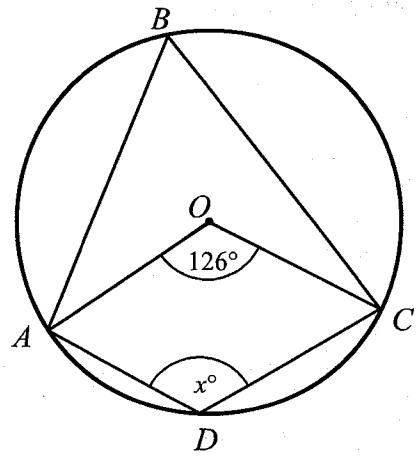
$(3x + 4)(x - \frac{6}{3})$

$(3x + 4)(x - 2)$

$(3x + 4)(x - 2)$

(Total for Question 8 is 2 marks)

9



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

Angle $AOC = 126°$
Angle $ADC = x°$

Work out the value of x.
You must show all your working.

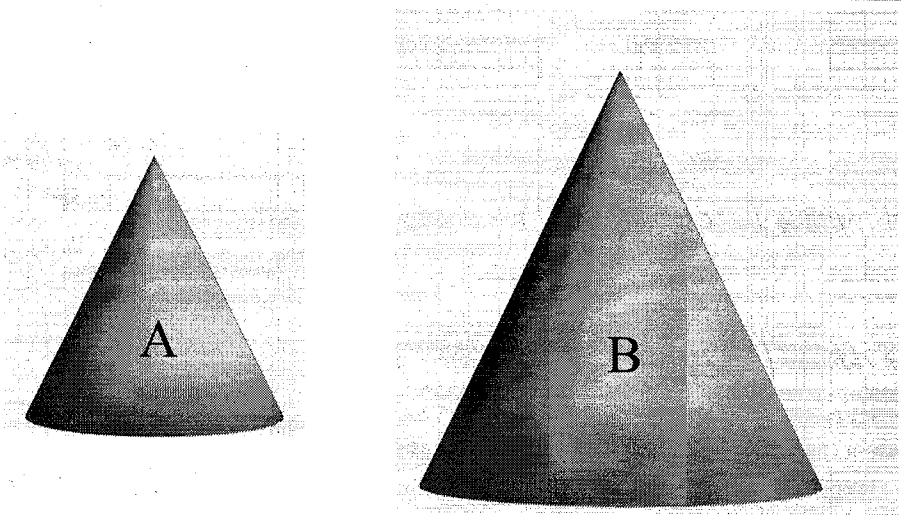
$ABC = \frac{126}{2} = 63°$ Angle at centre is ~~two~~ twice angle at circumference

$x = 180 - 63 = 117°$ opposite angles in a cyclic quadrilateral add to 180°

117 °

(Total for Question 9 is 3 marks)

10



The two cones, A and B, are mathematically similar.

Cone A has a volume of 1250π cm^3
Cone B has a volume of 5120π cm^3

The total surface area of cone A is 825 cm^2

Calculate the total surface area of cone B.

$\frac{5120\pi}{1250\pi} = \frac{512}{125}$ (s.f for volume)

s.f for length $= \sqrt[3]{\frac{512}{125}} = \frac{8}{5}$

s.f for area $= \left(\frac{8}{5}\right)^2 = \frac{64}{25}$

$825 \times \frac{64}{25} = 2112$ cm^2

2112 cm^2

(Total for Question 10 is 3 marks)