Name: _____ Class: _____

St George Girls High School

Year 11

Common Test – 1

2015

Mathematics

General Instructions

- Time: 70 minutes (including reading time)
- Write using blue or black pen
- Calculators may be used
- Show all necessary working
- All diagrams should be at least $\frac{1}{3}$ or $\frac{1}{2}$ of a page in size.
- All diagrams needs to have proper label and appropriate scale.

Total marks - 52

Section I
Total marks (4)
Attempt Questions 1 – 4
Use the answer sheet provided

Section II
Total marks (48)
Attempt Questions 5 – 12
Start each question on a new sheet of paper.

Section I

4 Marks
Attempt Questions 1 – 4

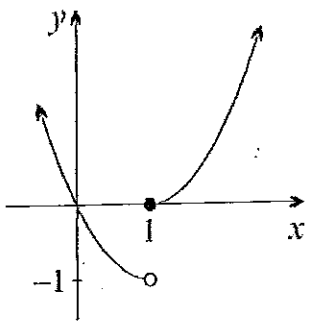
Use the multiple choice answer sheet provided for Questions 1 – 4.

1. Evaluate $\sqrt{\frac{0.9+1.4}{5.2-1.6}}$, correct to 2 decimal places.

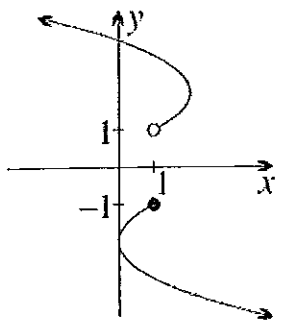
   (A) 0.42
   (B) 0.79
   (C) 0.8
   (D) 0.80

2. Which of the following does not represent a function?

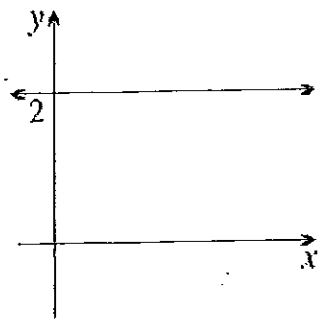
(A)



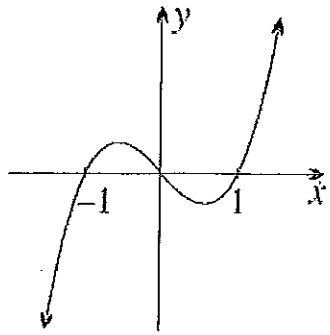
(B)



(C)

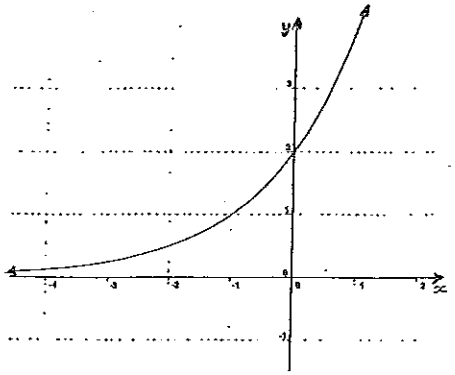


(D)



Section I (cont'd)

3. What is the equation of the following function?



(A) $y = 2^{x+1}$

(B) $y = 2^x + 1$

(C) $y = 2^{x-1}$

(D) $y = 2^x - 1$

4. When $y = x^2$ is translated 2 units up and 1 unit to the left, the equation of the new function is:

(A) $y = (x+2)^2 - 1$

(B) $y = (x+1)^2 + 2$

(C) $y = (x-2)^2 - 1$

(D) $y = (x-1)^2 + 2$

Section II

48 marks
Attempt Questions 5 – 12
Start each question on a new sheet of paper.

In Questions 5 – 12, your responses should include relevant mathematical reasoning and/or calculations.

Question 5 (6 Marks) – Start on a new sheet of paper Marks

Simplify:

a) $(7x^2 - 5x + 13) - (5x^2 - 2x + 5)$. 1

b) $\frac{6x^2 - 2x^2}{(-5x)^2}$. 1

c) $\left(a + \frac{1}{2}\right)\left(a - \frac{1}{2}\right)$ 1

d) $x - \frac{x^2}{x+2}$ 1

e) $\frac{2k^2 - 3k - 2}{8k^3 + 1}$ 2

Question 6 (6 Marks) – Start on a new sheet of paper Marks

a) Factorise fully:

(i) $3a^3 - 9a^2 - ab + 3b$ 1

(ii) $4a^3 + 40a^2 + 100a$ 1

(iii) $8t^2 + 18t - 5$ 1

b) Solve the following equations:

(i) $12 - \frac{x}{5} = 7$ 1

(ii) $\frac{p+5}{3} - \frac{p-2}{5} = 1$ 1

c) By forming a suitable pair of equations and solving them, express the following recurring decimal in fraction form: 1

$0.\dot{0}3\dot{5}$

Question 7 (6 Marks) – Start on a new sheet of paper Marks

a) Solve the following equations:

(i) $k^2 - 4k - 5 = 0$ 2

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

b) The product of two consecutive positive numbers is 702. Use a quadratic equation to find the two numbers. 2

Question 8 (6 Marks) – Start on a new sheet of paper Marks

a) Solve the following simultaneous equations using the substitution method:

$y = 2 - x$ and
$y = x^2$ 2

b) Solve the following simultaneous equations using the elimination method:

$3x + 2y = 6$ and
$5x + 3y = 11$ 2

c) A group of 5 adults and 3 children paid a total of \$108 for their concert tickets. Another group of 3 adults and 10 children paid \$155. Find the cost of an adult ticket and the cost of a child ticket. 2

Question 9 (6 Marks) – Start on a new sheet of paper Marks

a) Fully simplify the following surds:

(i) $\sqrt{150} + \sqrt{45} - \sqrt{24}$ 1

(ii) $(\sqrt{3} - 1)^2$ 1

b) Rewrite the following surds with rational denominator.

(i) $\frac{3}{5\sqrt{6}}$ 1

(ii) $\frac{\sqrt{3}}{2\sqrt{5}+\sqrt{3}}$ 2

c) Given that $f(x) = x^2 - 2$, find the value of: 1

$$\frac{1}{3}[f(-1) + f(0) + f(1)]$$

Question 10 (6 Marks) – Start on a new sheet of paper Marks

a) Solve the following quadratic equation by completing the square: 2

$$x^2 - 2x - 24 = 0$$

b) (i) Find 'x' and 'y' intercepts of the linear function: 1

$$y = 3x + 1$$

(ii) On the same number plane, sketch 2

$y = 3x + 1$ and
$y = 4$

(iii) Find the solution to the simultaneous equations given in part (ii) by reading the point of intersection from the graph. 1

Question 11 (6 Marks) – Start on a new sheet of paper Marks

a) Find the domain and range of the function: 1

$$f(x) = x^2 - 2$$

b) Draw a neat sketch of $f(x) = x^2 - 2$, showing all intercepts. 2

c) Draw a neat sketch of $y = 2^{-x}$, showing at least 2 points on the curve and also locate other significant features like intercepts and asymptote/s. 3

Question 12 (6 Marks) – Start on a new sheet of paper Marks

a) Find the domain and range of the function: 2

$$f(x) = \frac{1}{\sqrt{x+1}}$$

b) Draw a neat sketch of the following function, showing all important features: 2

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

c) Find the value of p and q such that 2

$$\frac{\sqrt{3}}{\sqrt{3}-2} = p - q\sqrt{3}$$

End of Paper

2015 MATHEMATICS YR 11 CT 1

1) $\sqrt{\frac{203}{3.6}} = 0.799\ldots \therefore 0.80$ (2 dp) — D

2) B fails vertical line test when $0 \le x \le 1$ — B

3) $(-1, 1)$ $(0, 2)$ $(1, 4)$ $\therefore y = 2^{x+1}$ — A

4) $y - 2 = (x+1)^2$

$y = (x+1)^2 + 2$ — B

Question 5

a) $7x^2 - 5x + 13 - 5x^2 + 2x - 5$

$= 2x^2 - 3x + 8$

b) $\frac{4x^2}{25x^2} = \frac{4}{25}$

c) $a^2 - \frac{1}{4}$

d) $\frac{x(x+2)}{x+2} - \frac{x^2}{x+2} = \frac{x^2 + 2x - x^2}{x+2}$

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

e) $\frac{(2k+1)(k-2)}{(2k+1)(4k^2-2k+1)} = \frac{k-2}{4k^2-2k+1}$

Question 6

a) i) $3a^2(a-3) - b(a-3)$

$= (a-3)(3a^2 - b)$

ii) $4a(a^2 + 10a + 25)$

$= 4a(a+5)^2$

iii) $(4t-1)(2t+5)$

b) i) $60 - x = 35$

$25 = x$

ii) $5(p+5) - 3(p-2) = 15$

$5p + 25 - 3p + 6 = 15$

$2p = -16$

$p = -8$

c) $1000x = 35.035\,035\ldots$

Let $x = 0.035\,035\,035$

$999x = 35$

$x = \frac{35}{999}$

Question 7

c) i) $(k-5)(k+1) = 0$

$k = 5$ or -1

ii) $3x - 1 = x^2 + x$

$0 = x^2 - 2x + 1$

$0 = (x-1)^2$

$x = 1$

Let the smaller number be x (where $x > 0$)

The next number is $x+1$.

$x(x+1) = 702$

$x^2 + x = 702$

$x^2 + x - 702 = 0$

$(x-26)(x+27) = 0$

$x = 26$ or -27

As $x > 0$, $x = 26$

So numbers are 26 and 27.

Question 8

a) $2 - x = x^2$

$0 = x^2 + x - 2$

$(x+2)(x-1) = 0$

$x = -2$ or 1

When $x = -2$, $y = 4$

$x = 1$, $y = 1$

$3x + 2y = 6$ $\xrightarrow{\times 3}$ $9x + 6y = 18$ (1)

$5x + 3y = 11$ $\xrightarrow{\times -2}$ $-10x - 6y = -22$ (2)

(1) + (2) $\quad -x = -4$

$x = 4$

$y =$

So $3(4) + 2y = 6$

$2y = -6$

$y = -3$ $\quad \therefore (4, -3)$

c) $5A + 3C = 108$ $\xrightarrow{\times 3}$ $15A + 9C = 324$ (1)

$3A + 10C = 155$ $\xrightarrow{\times -5}$ $-15A - 50C = -775$ (2)

(1) + (2) $\quad -41C = -451$

$C = 11$

So $3A + 110 = 155$

$3A = 45$

$A = 15$

Adults cost $15 and children $11.

Question 9

a) i) $\sqrt{150} + \sqrt{45} - \sqrt{24}$

$= 5\sqrt{6} + 3\sqrt{5} - 2\sqrt{6}$

$= 3\sqrt{6} + 3\sqrt{5}$

ii) $(\sqrt{3} - 1)^2 = 3 - 2\sqrt{3} + 1$

$= 4 - 2\sqrt{3}$

b) i) $\frac{3\sqrt{6}}{30} = \frac{\sqrt{6}}{10}$

ii) $\frac{\sqrt{3}(2\sqrt{5}-\sqrt{3})}{20-3}$

$= \frac{\sqrt{3}(2\sqrt{5}-\sqrt{3})}{17}$ OR $\frac{2\sqrt{15}-3}{17}$

c) $\frac{1}{3}\left[[(-1)^2-2]+[0^2-2]+[1^2-2]\right]$

$= \frac{1}{3}[1-2+(-2)+1-2]$

$= -\frac{4}{3}$

QUESTION 10

a) $x^2-2x = 24$

$x^2-2x+1 = 25$

$(x-1)^2 = 25$

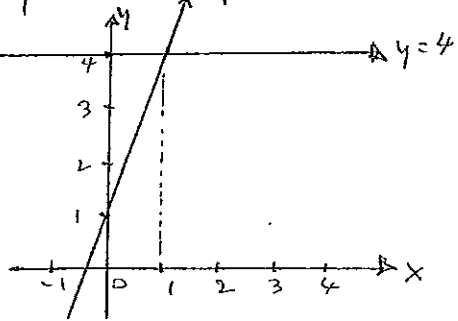
$x-1 = \pm 5$

$x = 6$ or -4

b) i) x intercept is $-\frac{1}{3}$ [when $y=0$]

y intercept is 1 [when $x=0$]

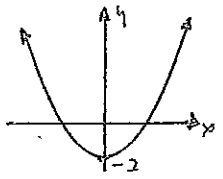
ii)



iii) (1,4) from graph

QUESTION 11

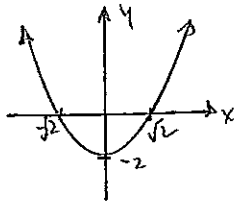
a)



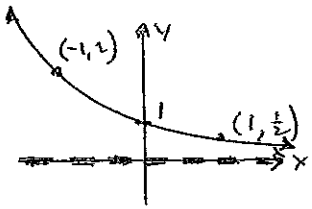
D: all real x

R: $y \geq -2$

b)

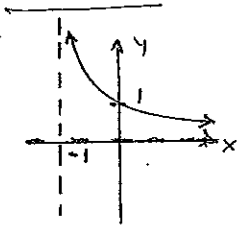


c)



QUESTION 12

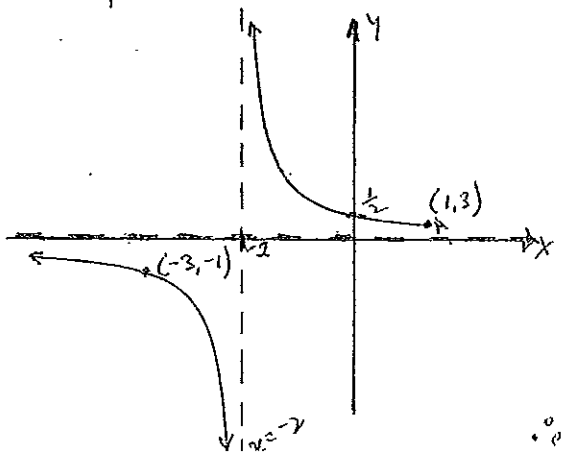
a)



D: $x > -1$

R: $y > 0$

b)



c)

$\frac{\sqrt{3}}{\sqrt{3}-2} \times \frac{\sqrt{3}+2}{\sqrt{3}+2}$

$= \frac{3+2\sqrt{3}}{3-4}$

$= -3-2\sqrt{3}$

$\therefore p=-3 \quad q=2$