Name: _____   Class: _____

St George Girls High School

Year 11

End of Preliminary Course Examination

2016

Mathematics

Instructions

1. Reading time – 5 minutes
2. Working time – 2 hours
3. Attempt **all** questions.
4. All necessary working must be shown.
5. Marks will be deducted for careless work or poorly presented solutions.

Section I
Total marks **(10)**
Attempt Questions 1 – 10
Use the answer sheet provided

Section II
Total marks **(70)**
Attempt Questions 11 – 17
Start each question in a new booklet

Section I

10 marks – 1 mark each
Attempt Questions 1 – 10

Use the multiple-choice answer sheet for Questions 1-10.

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1 Which of the following is equivalent to $\sqrt{243} + 2\sqrt{75}$?

(A) $19\sqrt{3}$

(B) $81\sqrt{3}$

(C) $106\sqrt{3}$

(D) $2\sqrt{318}$

2 What is the domain of the function $f(x) = \dfrac{1}{(x-3)(1-x)}$?

(A) All real values of x, $x \neq -1$ or $x \neq -3$

(B) All real values of x, $x \neq -1$ or $x \neq 3$

(C) All real values of x, $x \neq 1$ or $x \neq -3$

(D) All real values of x, $x \neq 1$ or $x \neq 3$

3 Solve $|2 - 3x| \geq 5$

(A) $x \leq -1$ or $x \geq 2\dfrac{1}{3}$

(B) $x \geq -1$ or $x \leq 2\dfrac{1}{3}$

(C) $x \leq -2\dfrac{1}{3}$ or $x \geq 1$

(D) $x \geq -2\dfrac{1}{3}$ or $x \leq 1$

4 The value of $\displaystyle\lim_{x \to 0} \frac{x^2 + 2x}{x}$ is equal to
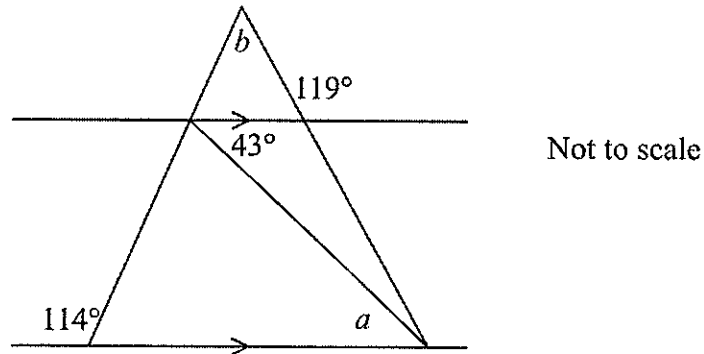
(A) 0

(B) 1

(C) 2

(D) Approaching infinity

5 What is the solution to the equation $x^2 + 2x - 7 = 0$?

    (A) $x = -1 \pm \sqrt{2}$

    (B) $x = -2 \pm \sqrt{2}$

    (C) $x = -2 \pm 2\sqrt{2}$

    (D) $x = -1 \pm 2\sqrt{2}$

6 What are the values of a and b?

Not to scale

    (A) $a = 43°$ and $b = 53°$

    (B) $a = 43°$ and $b = 61°$

    (C) $a = 45°$ and $b = 53°$

    (D) $a = 45°$ and $b = 61°$

7 If $y = 2x\sqrt{x}$, which of the following is an expression for $\dfrac{dy}{dx}$.

    (A) $2\sqrt{x}$

    (B) $3\sqrt{x}$

    (C) $\dfrac{1}{x}$

    (D) $\dfrac{1}{2\sqrt{x}}$

8 Which of the following is an expression for $\dfrac{(1-\cos x)(1+\cos x)}{\cos^2 x}$?
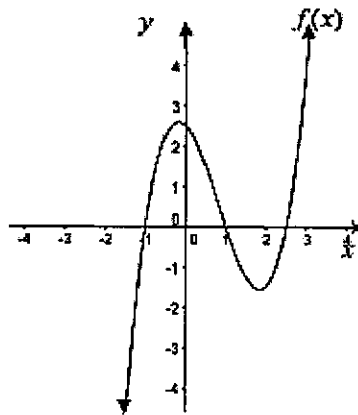
    (A) 0

    (B) $\tan x$

    (C) $\sec^2 x$

    (D) $\tan^2 x$

9 A regular polygon is such that the size of each interior angle is 150° more than the size of each exterior angle. How many sides does the polygon have?
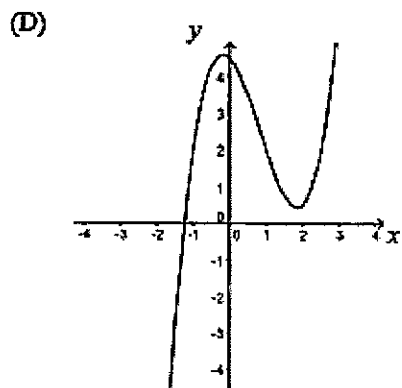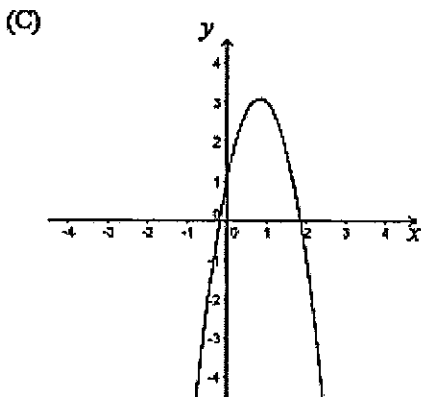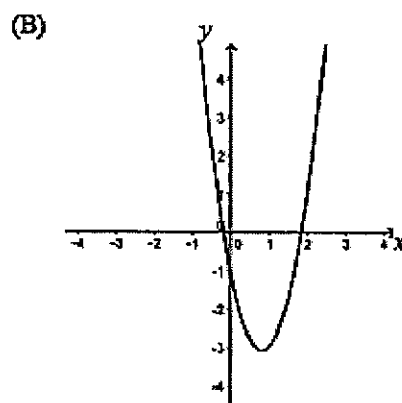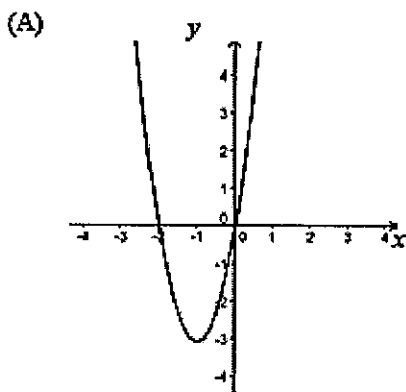
(A) 12
(B) 16
(C) 20
(D) 24

10.

Examine the features of the graph of $f(x)$ supplied.

Which of the graphs below best represents $f'(x)$?

(A)

(B)

(C)

(D)

End of Section I

Section II

70 marks
Attempt Questions 11 – 17

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

Question 11 (10 marks) Use a SEPARATE writing booklet   **Marks**

(a)   Solve $\dfrac{1}{2}(y-3)-\dfrac{1}{3}(y-2)=3$ 2

(b)   Rationalise the denominator of $\dfrac{1}{\sqrt{5}-1}$ 2

(c)   Find the exact value of $\tan 240°$ 1

(d)   Simplify fully $\dfrac{a^2-b^2}{3a^2-3ab}\times\dfrac{2a^2+2ab}{a^2+2ab+b^2}$ 3

(e)   Solve $2x^2-5x=3$ 2

Question 12 (10 marks) Use a SEPARATE writing booklet   **Marks**

(a) Differentiate with respect to x.

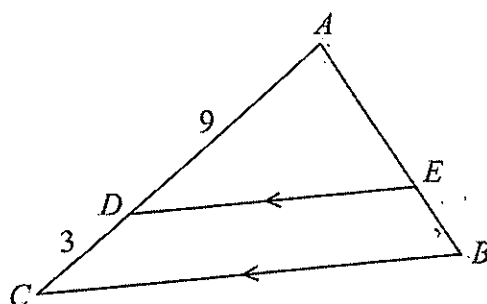   (i) $7x^5 + \dfrac{4}{x^2}$ 1

   (ii) $x(1-x)^6$ 2

   (iii) $\dfrac{3x}{2-x}$ 2

(b) ABC is a triangle with DE drawn parallel to BC.   2

Not to scale

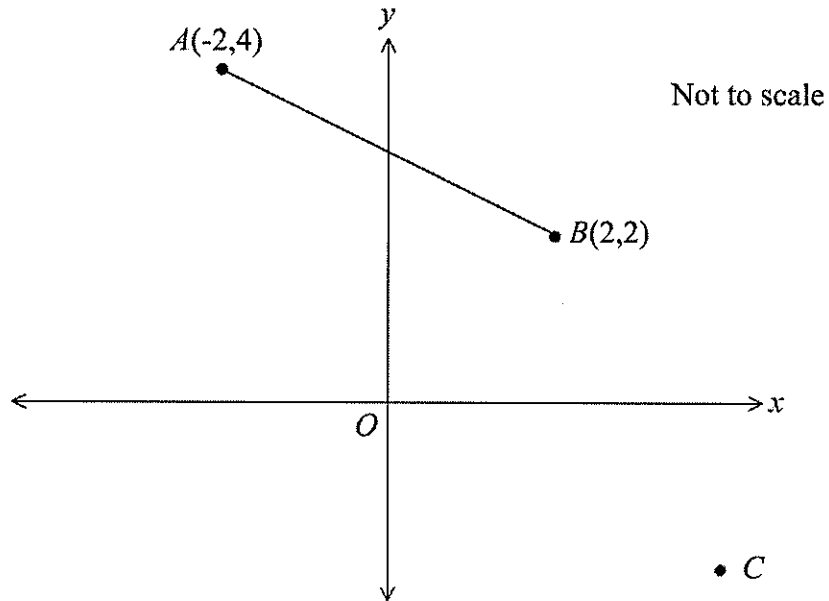In the diagram $AD = 9$, $DC = 3$ and $AE = 6$
Find the length of BE giving reasons.

(c)   Solve $|2x - 5| = 3x + 1$ 3

Question 13 (10 marks) Use a SEPARATE writing booklet   **Marks**

(a) The diagram shows the points $A(-2,4)$, $B(2,2)$ and $O(0,0)$.
     Point C is the fourth vertex of the parallelogram $OABC$.

(i)   Show that the equation of AB is $x + 2y - 6 = 0$.   2

(ii) Show that the length of AB is $2\sqrt{5}$.   1

(iii) Calculate the perpendicular distance from O to the line AB.   1

(iv) What are the coordinates of C?   1

(b) The graphs of two trigonometric functions for $180° \leq x \leq 360°$ are shown.
     Write down an equation for graph (i) and for graph (ii).   2
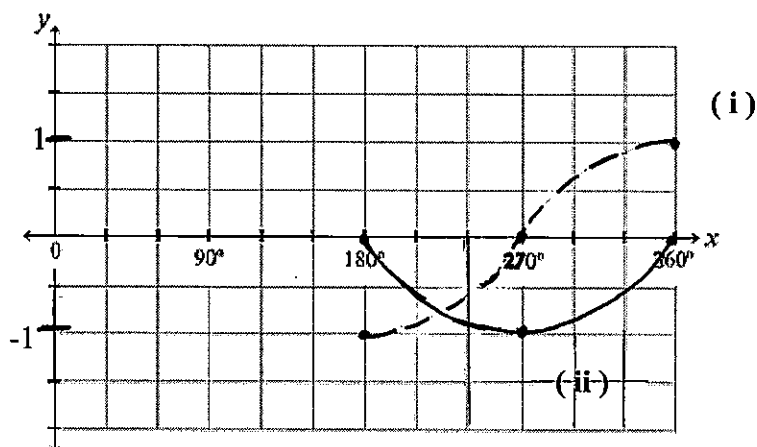
(c)   A function is defined as: $\left\{ \begin{matrix} -x^2 & \text{when } x \leq 0 \\ 5x-4 & \text{when } x > 0 \end{matrix} \right.$
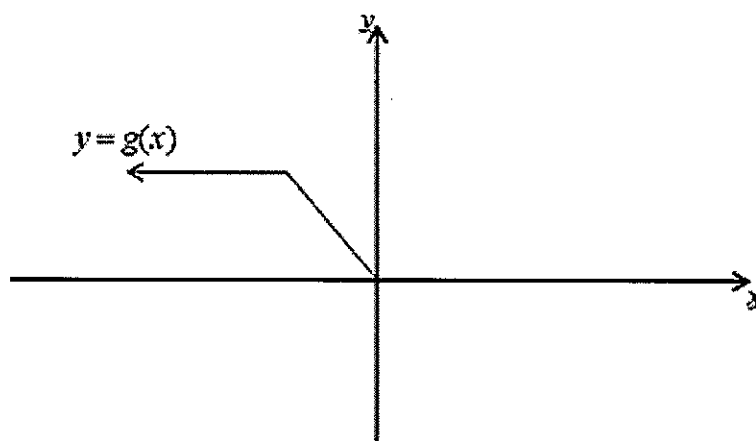
Evaluate $f(-2) + f(3) - f(0)$ **2**

(d)

Part of the graph of $y = g(x)$ is sketched below for $x \leq 0$.
The function $y = g(x)$ is odd.   **1**
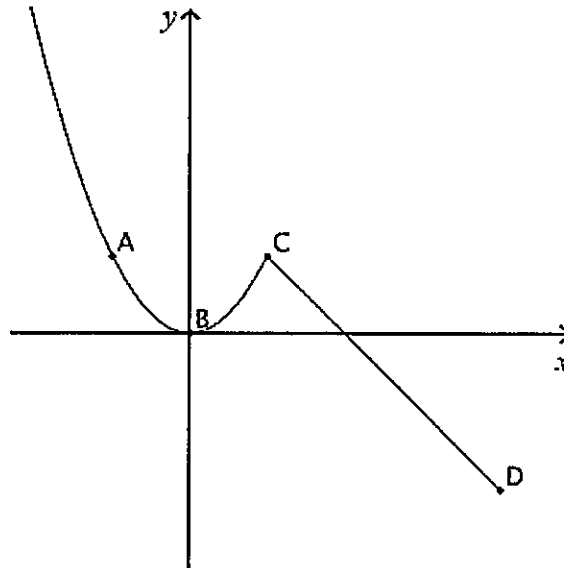

Use the template provided on the <u>back of the multiple</u>

<u>choice answer sheet</u> to sketch the graph of $y = g(x)$ for $x > 0$.

Question 14 (10 marks) Use a SEPARATE writing booklet   **Marks**

(a)

The graph of $y = f(x)$ is shown below, with four points, A B, C and D shown on the curve.   1

List the point(s) where the function $f(x)$ is not differentiable.

(b)   Find the equation of a straight line that makes an angle of $135°$ with
the positive direction of the x-axis and has a y-intercept of 5.
Express your answer in gradient-intercept form.   **2**

(c)   Sketch the graph of the function $y = \dfrac{3}{2x-1}$, showing all necessary features.   **2**

(d)   Prove $\tan\theta - \tan\theta\sin^2\theta = \sin\theta\cos\theta$ **2**

(e)   Find the equation of the normal to the curve $y = x^2 - 6x$ at $x = -1$ **3**

Question 15 (10 marks) Use a SEPARATE writing booklet   **Marks**

(a)   Solve $\sin x = -\dfrac{1}{\sqrt{2}}$ for $0° \leq x \leq 360°$ 2

(b)
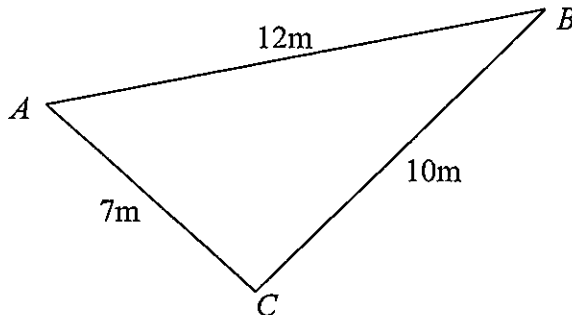
(i)   Show that $\angle ACB = 88°$ to the nearest degree.   2

(ii)   Calculate the area of this triangle correct to 1 decimal place.   2

(c)   *PQRS* is a parallelogram. Perpendiculars are dropped from *P* and *R* to meet
       the diagonal *QS* at *T* and *V* respectively.
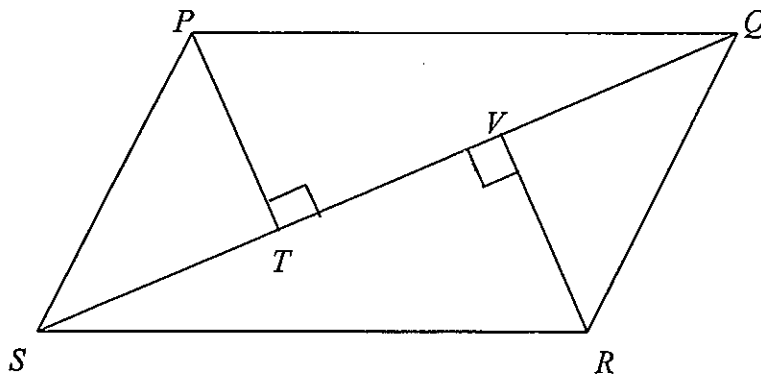
(i)   Prove that the triangles *PTQ* and *RVS* are congruent.   3

(ii)   Prove that *P* and *R* are the same distance from *QS*.   1

Question 16 (10 marks) Use a SEPARATE writing booklet

Marks

(a) Differentiate $y = 3x^2 - 2$ from first principles.

2

(b) A ship travels 30 km from A on a bearing of $105°T$ to port B and then travels 20 km at a bearing of $200°T$ to port C, as shown in the diagram below.
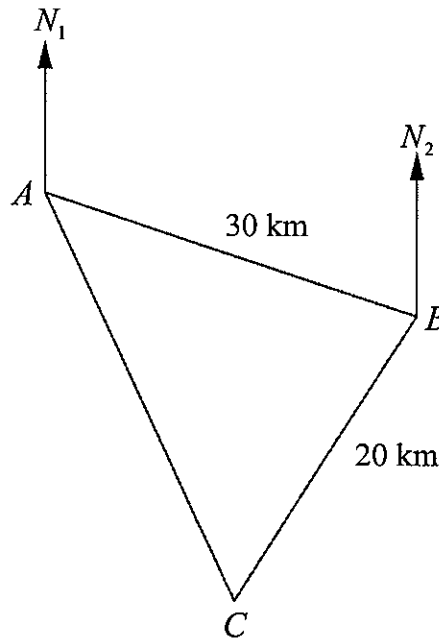
NOT TO SCALE

Copy or trace the diagram into your writing booklet.

(i) State the size of $\angle ABC$.

1

(ii) Hence, find the distance between port C and port A correct to the nearest metre

2

(c) Write a set of inequalities that satisfy the shaded region given.

3
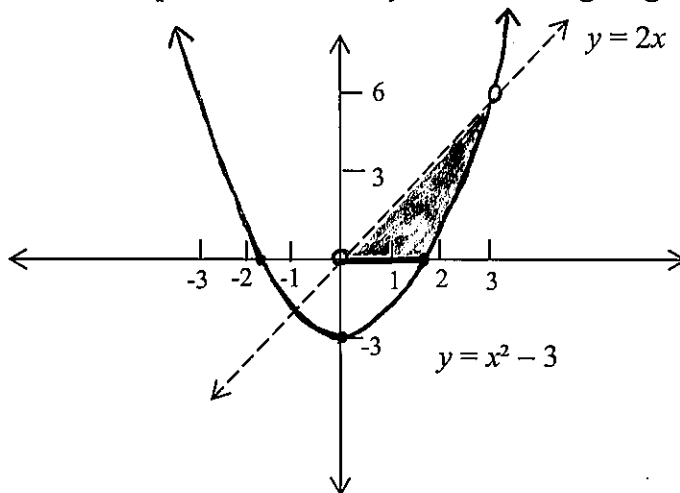
(d) State the largest possible domain and range for $y = \dfrac{x}{|x|}$.

2

Question 17 (10 marks) Use a SEPARATE writing booklet   **Marks**

Consider the semicircle $y = \sqrt{25 - x^2}$ for parts (a) - (f) below.

(a)   Find the derivative of $y = \sqrt{25 - x^2}$.   **2**

(b)   Sketch the semicircle $y = \sqrt{25 - x^2}$.   **1**

(c)   Show that the tangent at $P\,(4,3)$ on the semicircle has equation $4x + 3y = 25$.   **2**

(d)   Verify that the tangent at P is perpendicular to the radius at P.   **2**

(e)   Find the x-intercept and the y-intercept of the tangent.   **2**

(f)   Find the area enclosed between the tangent and the two axes.   **1**

End of Examination

QUESTION 13 (d)

NAME :_____

Part of the graph of $y = g(x)$ is sketched below for $x \leq 0$.
The function $y = g(x)$ is odd.
Sketch the graph of $y = g(x)$ for $x > 0$ on the graph provided below.

1

Section I

Year 11 End of Preliminary Course Examination

Mathematics

Multiple-choice Answer Sheet - Questions 1 – 10

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample   2 + 4 =   (A) 2   (B) 6   (C) 8   (D) 9

A ◯   B ●   C ◯   D ◯

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ●   B ✖   C ◯   D ◯

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

correct

A ✖   B ✖   C ◯   D ◯

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1. A ◯   B ◯   C ◯   D ◯

2. A ◯   B ◯   C ◯   D ◯

3. A ◯   B ◯   C ◯   D ◯

4. A ◯   B ◯   C ◯   D ◯

5. A ◯   B ◯   C ◯   D ◯

6. A ◯   B ◯   C ◯   D ◯

7. A ◯   B ◯   C ◯   D ◯

8. A ◯   B ◯   C ◯   D ◯

9. A ◯   B ◯   C ◯   D ◯

10. A ◯   B ◯   C ◯   D ◯