BA PROVINCIAL FREE BIRD INSTITUTE

ANNUAL EXAMINATION 2020

YEAR 12 MATHEMATICS

Time Allowed: Three Hours
(An extra ten minutes allowed for reading this paper)

INSTRUCTIONS

1. Write **all** your answers in the appropriate places provided in the **Answer Book.**
2. Write your **Index number** on the **front page** of your **Answer Book.**
3. You may use calculators provided they are silent, battery operated and non-programmable.
4. Unless otherwise stated, all rounding off should be corrected to **two decimal places.**
5. The required table and formulae are given on **pages 18 – 20.**

SUMMARY OF QUESTIONS

There are 9 strands. All are compulsory.

	STRANDS	TOTAL MARK	SUGGESTED TIME
1	Basic Mathematics	12	22 minutes
2	Algebra	18	32 minutes
3	Graphs	12	22 minutes
4	Co-ordinate Geometry	7	13 minutes
5	Trigonometry	10	18 minutes
6	Matrices and Transformation	7	13 minutes
7	Statistics	6	10 minutes
8	Probability	10	18 minutes
9	Calculus	18	32 minutes
	Total	**100**	**180 minutes**

STRAND 1 BASIC MATHEMATICS [12 marks]

- This strand has **7 Questions.**
- Choose the best answer and write the **letter** of your choice for **Questions 1-3**
- Show all working for **Questions 4 – 7.**

1. Which of the statements shown below is **false** about credit cards?
   A. You will not be charged interest if you pay your closing balance off in full on the due date.
   B. Your credit limit is a reasonable guide to how much you can spend on your credit card.
   C. You can use your credit card overseas.
   D. Interest is charged on a cash advance from the day of withdrawal.

(1 mark)

2. If $\log k = -2$, then $\frac{\log k^2}{2} =$
   A. -4
   B. -2
   C. 2
   D. 8

(1 mark)

3. Alifereti bought a keyboard on the following **terms:**

   - $0 deposit.
   - 12 monthly installments of $60.

   The **total amount** he paid for the keyboard was

   A. $12
   B. $60
   C. $720
   D. $820

(1 mark)

4. Solve the equation $5^{2x+1} = 25$ **(1 mark)**

5. Simplify $\frac{3}{1-\sqrt{3}}$ by rationalizing the denominator. **(2 marks)**

6. Simplify $\frac{9^{4x}}{3^{x}}$ **(2 marks)**

7. Study the operation table for {0, 1, 2, 3, 4} shown below and then answer the questions that follow.

x	0	1	2	3	4
0	0	0	0	0	0
1	0	1	2	3	4
2	0	2	4	1	3
3	0	3	1	4	2
4	0	4	3	2	1

(a) The table above shows multiplication in **modulo m.**

What is the value of **m**? **(1 mark)**

(b) Give the **identity** element. **(1 mark)**

(c) Give the **inverse** of 0? **(1 mark)**

(c) The above table does **not** represent a **group**. Give a reason for this. **(1 mark)**

STRAND 2 ALGEBRA [18 marks]

- This strand has **11 Questions.**
- Choose the best answer and write the **letter** of your choice for **Questions 1-3**
- Show all working for **Questions 4 – 11.**

1. The **solution** set of $(x + 3)(x - 4) = 0$ is

   A. $\{3, 4\}$

   B. $\{-3, 4\}$

   C. $\{3, -4\}$

   D. $\{-3, -4\}$ **(1 mark)**

2. If $f(x) = x^2 + 2x - 1$ is divided by $x - 3$, the **remainder** is

   A. 14

   B. 15

   C. 16

   D. 17 **(1 mark)**

3. The **solution** set for $-4x \geq 4$ is given by

   A. $x < -1$

   B. $x \leq -1$

   C. $x \geq -1$

   D. $x > -1$ **(1 mark)**

4. Calculate the value of $\sum_{n=1}^{4}(n + 3)$ **(2 marks)**

5. Solve $\frac{x+2}{2} - \frac{x-3}{3} = -2$ **(2 mark)**

6. A quadratic equation is given as $2x^2 + 4x - 1 = 0$.

   (i) Calculate the value of the **discriminant.** **(1 mark)**

   (ii) Hence, state the **nature** of the roots. **(1 mark)**

7. Use the **quadratic formula** to solve the equation $x^2 - 2x - 3 = 0$ **(2 marks)**

8. Make x the **subject** of the formula $y = \frac{2x+3}{x-4}$ **(2 marks)**

9. A polynomial function is given by $f(x) = x^3 - 2x^2 - 5x + 6$.
   Given that $x + 2$ is one of the factors of $f(x)$, find the other two factors. **(2 marks)**

10. A geometric sequence is given as 24, 12, 6, ...

    Find the **sum infinity**. **(1 mark)**

11. A boy saved some money over a period of 80 weeks. He saved 3 cents in week 1, 6 cents in week 2, 9 cents in week 3, 12 cents in week 4 and so on until week 80.

    His weekly savings formed an arithmetic sequence 3, 6, 9, 12, ...

    (i) How much did he save in week 29? **(1 mark)**

    (ii) Calculate the total amount he saved over the 80 week period. **(1 mark)**

STRAND 3 GRAPHS [12 marks]

- This strand has **6 Questions.**
- Choose the best answer and write the **letter** of your choice for **Questions 1-3**
- Show all working for **Questions 4 – 6.**

1. A relation is given by a set of ordered pairs: {(2,3),(3,4),(4,5)}

The **inverse** of this relation is

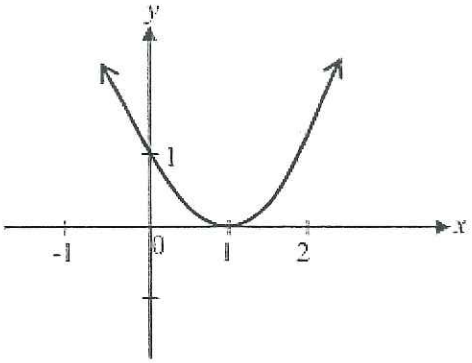
A. { (3,2), (4,3), (5,4) }

B. { (2,3), (3,4), (5,4) }

C. {(-2, 3), (-3,4), (-5,4) }

D. { (-2,-3), (-3,-4), (-5,-4) } **(1 mark)**

2. The graph of the function $y = (x-1)^2$ is given below.



The **domain** of this function is

A. $x > 0$

B. $x \in R$

C. $x < 0$

D. $x \geq 0$ **(1 mark)**

3. A **circle** is defined by the equation $(x-3)^2 + y^2 = 4$.

   The value of the **radius** of this circle is

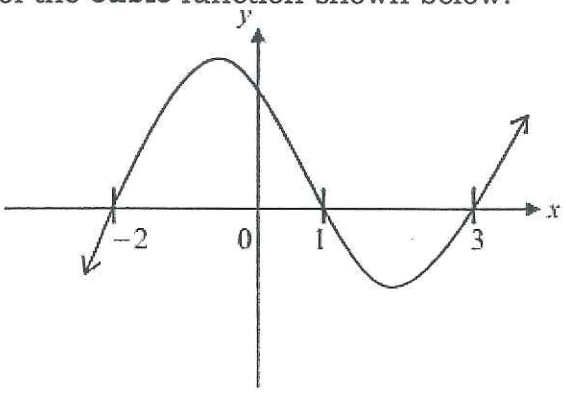
   A. 2 units

   B. 3 units

   C. 4 units

   D. 9 units **(1 mark)**

4. Give the equation of the **cubic** function shown below.



(1½ marks)

5. Find the **coordinates** of the points of intersection of the functions $y = x + 4$ and $y = \frac{14x+56}{x+25}$

(3 marks)

6. A hyperbolic function is given by $y = \frac{x-4}{x+2}$

   (i) Find the **x-intercept** of this function. **(½ mark)**

   (ii) Find the **y-intercept** of this function. **(½ mark)**

   (iii) State the equation of the **vertical asymptote**. **(½ mark)**

   (iv) State the equation of the **horizontal asymptote**. **(½ mark)**

   (v) Hence, sketch the **graph** of this function. **(2½ mark)**

STRAND 4 COORDINATE GEOMETRY [7 marks]

- This strand has **4 Questions.**
- Choose the best answer and write the **letter** of your choice for **Questions 1-2.**
- Show all working for **Questions 3 & 4.**

1. An equation of a line which is **perpendicular** to $y = \frac{1}{3}x + 3$ is

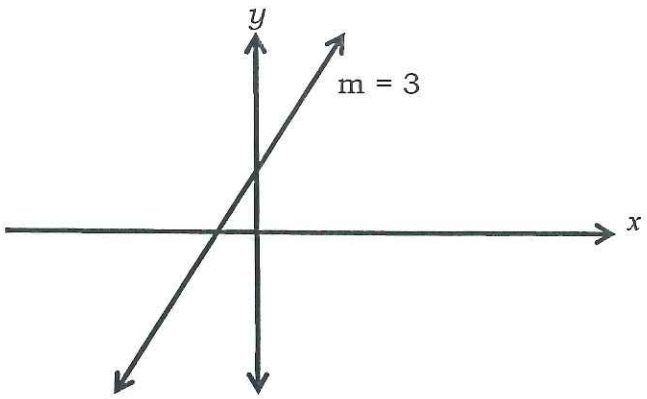
   A. $y = 3x$

   B. $y = -3x$

   C. $y = \frac{1}{3}x$

   D. $y = -\frac{1}{3}x$ **(1 mark)**

2. The gradient of the line shown below is 3.



The point (0,-3) lies on this line. Which of the following points also lies on this line?

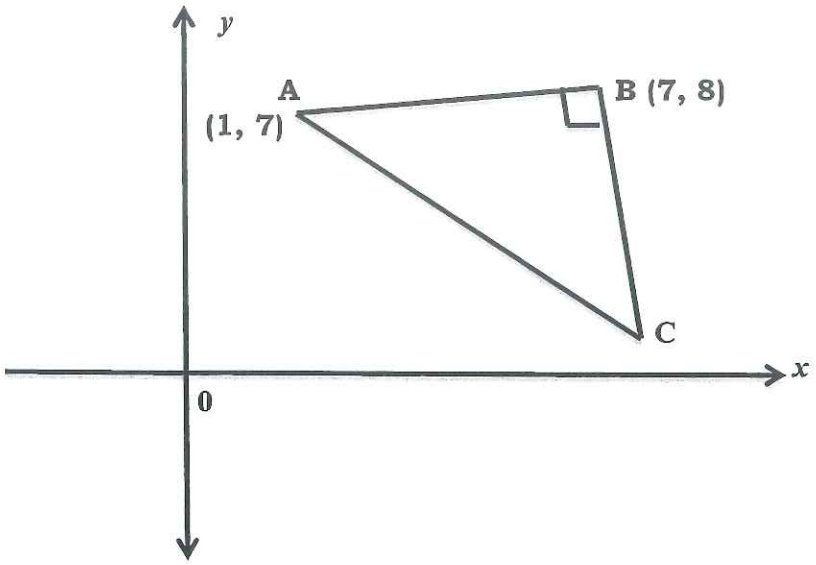
A. (1, 5)

B. (1, 3)

C. (1, 2)

D. (1, 0) **(1 mark)**

3. The diagram given below shows a **right angled** triangle triangle with vertices **A, B** and **C**.



The coordinates of points **A** = (1, 7) and **B** = (7, 8). **AB** is **perpendicular** to **BC**.

(i) Calculate the **length** of **AB**. **(1 mark)**

(ii) Calculate the **gradient** of **AB**. **(1 mark)**

(iii) Hence, determine the **gradient** of **BC**. **(1 mark)**

4. The points (3,-2), (4,2) and (5, **p**) are **collinear**, that is they lie on the **same line**.

Calculate the value of **p**. **(2 marks)**

STRAND 5 TRIGONOMETRY [10 marks]

- This strand has **6 Questions.**
- Choose the best answer and write the **letter** of your choice for **Questions 1-2.**
- Show all working for **Questions 3 - 6.**

1. How many radians make up a **half turn**?

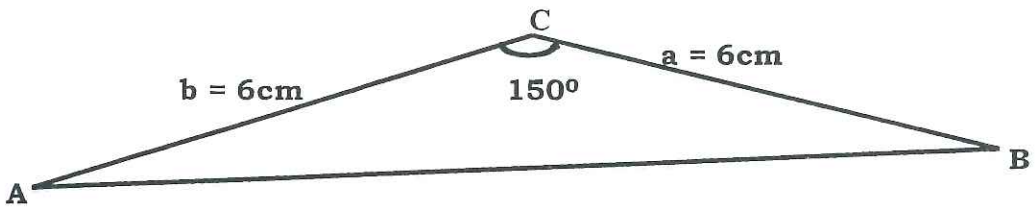
   A. 2

   B. π

   C. 2π

   D. 180 **(1 mark)**

2. An **isosceles** triangle is shown below.



The **area** of this triangle in cm^2 is

   A. 3

   B. 6

   C. 9

   D. 18 **(1 mark)**