NESA NUMBER

NBCS
NORTHERN BEACHES CHRISTIAN SCHOOL

Year 10 5.3 Mathematics

2019 Yearly

General Instructions

- Reading time – 5 minutes
- Working time – 90 minutes
- Write using blue/black pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used

Total marks: 90

Section I

20 marks
Attempt Questions 1 - 20
Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1-20

---

1 What is the value of $\frac{2.4+3.6}{11.5+2.1}$? Answer correct to two decimal places.

(A) 0.44

(B) 2.62

(C) 2.66

(D) 4.81

2 Simplify $8x+3y-4x-7y$.

(A) $4x+10y$

(B) $4x+4y$

(C) $4x-10y$

(D) $4x-4y$

3 What is the probability of throwing a number less than 1, in a single throw of one die?

(A) 0

(B) $\frac{1}{5}$

(C) $\frac{1}{6}$

(D) 1

4 Which one of the following fractions lies between $\frac{1}{4}$ and $\frac{3}{4}$?

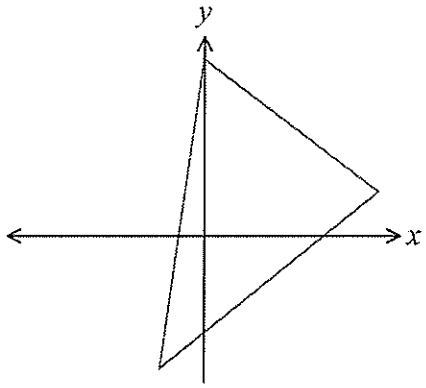
(A) $\frac{3}{5}$

(B) $\frac{5}{6}$

(C) $\frac{8}{9}$

(D) $\frac{9}{8}$

5 The diagram shows a triangle drawn on a number plane.



Which of these coordinate points could be a vertex of the triangle?

(A) (–1, 0)

(B) (0, 4)

(C) (4, –2)

(D) (5, 0)

6 A speed camera recorded the following speeds (km/h) of eight motor vehicles.

43, 51, 55, 55, 57, 58, 59, 78

Which of the following is true?

(A) Mean is 56 km/h

(B) Median is 57 km/h

(C) Mode is 55 km/h

(D) Range is 58 km/h

7 Expand $-2x(x-1)$.

(A) $-4x-2$

(B) $-4x+2x$

(C) $-2x^2+2$

(D) $-2x^2+2x$

8 Which of the following algebraic expressions is equivalent to $\frac{1}{4}+\frac{x}{8}$?

(A) $\frac{1+x}{8}$

(B) $\frac{2+x}{8}$

(C) $\frac{1+x}{12}$

(D) $\frac{8+x}{32}$

9 If $f(x) = x^2 - 2x$, give an expression for $f(x+2) - f(1)$.

(A) $x^2 + 2x$

(B) $x^2 + 6x - 1$

(C) $x^2 + 2x + 1$

(D) $x^2 + 2x - 8$

10 The equation of the parabola $y = x^2 - 8x + 18$ may be written in the form:

(A) $y = (x-4)^2 + 34$

(B) $y = (x+4)^2 + 2$

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

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

11 The coordinates of the points where $y = x^2 - 9$ cuts the x axis are:

(A) $(0, -3)$ and $(0, 3)$

(B) $(-3, 0)$ and $(3, 0)$

(C) $(-9, 0)$ and $(9, 0)$

(D) $(0, -9)$ and $(0, 9)$

12 The graph given by $y = 2^{x-2} + 1$ would be:

(A) a circle

(B) a hyperbola

(C) an exponential

(D) a parabola

13 The graph of a hyperbola has the equation $y = \frac{1}{x-1} + 2$. The asymptotes of the graph are:

(A) $x = 2, y = 1$

(B) $x = 1, y = 2$

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

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

14 The gradient of the line $2x + 3y - 36 = 0$ is:

(A) $-\frac{3}{2}$

(B) $-\frac{2}{3}$

(C) $\frac{2}{3}$

(D) $\frac{3}{2}$

15 The distance between $A(4,-2)$ and $B(-3,5)$ is

(A) $\sqrt{10}$

(B) $\sqrt{98}$

(C) 10

(D) $\sqrt{198}$

16 The equation of the line parallel to $y = 4x - 1$ and has an x intercept -3 is:

(A) $y = 4x - 3$

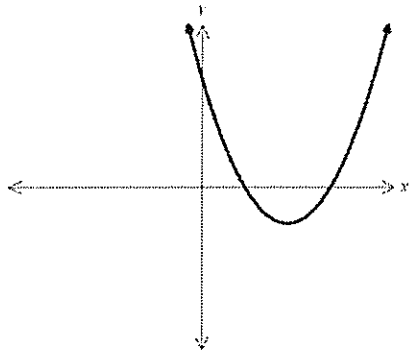
(B) $y = -4x - 3$

(C) $y = 4x + 12$

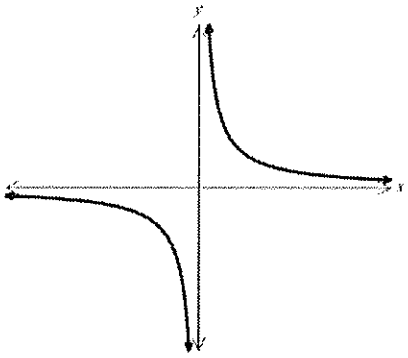
(D) $y = -4x - 12$

17 Which graph does not represent a function?

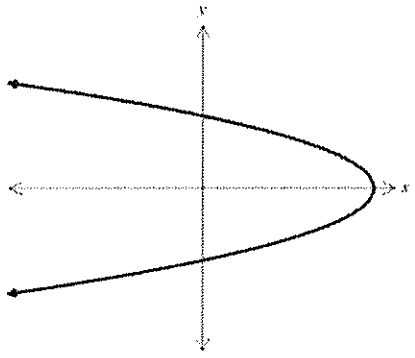
(A)



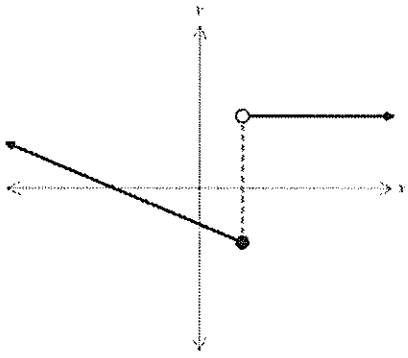
(B)



(C)



(D)



18 A letter is chosen from the word MATHEMATICS. The probability that the letter is neither M or A is:

(A) $\frac{2}{11}$

(B) $\frac{4}{11}$

(C) $\frac{7}{11}$

(D) $\frac{9}{11}$

19 The function $y = -x^2 - 3$ is:

(A) concave down and vertically translated down 3 units

(B) concave down and vertically translated up 3 units

(C) concave up and vertically translated down 3 units

(D) concave up and vertically translated up 3 units

20 $9a^4 - 1$ is:

(A) a perfect square

(B) a cubic

(C) the difference of two squares

(D) not a function

End of Multiple Choice Questions

Section II

70 marks
Attempt Questions 21 – 60
Allow about 60 minutes for this section

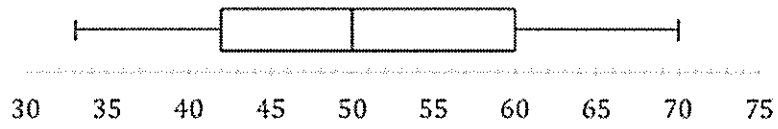
Answer the questions in the spaces provided.

All necessary working should be shown in every question.

---

21 Solve the equation $2x+4=9$. **1**

22 The results of a class test are shown in the box-and-whisker plot below.



(i) What is the range? **1**

(ii) What is the interquartile range? **1**

23 Ebony goes to a shop that sells vanilla, chocolate, strawberry and rainbow ice creams. She decides to buy two ice creams, each one a different flavour. How many different choices are possible? **1**

24 What is the mode of the data in the following stem-and-leaf plot? **1**

2	1 6 7 8 9
3	1 1 1 3 4 4 7 7
4	0 2 3 4 6 6 9 9
5	1 4 5 8

Key: 2|1 = 21

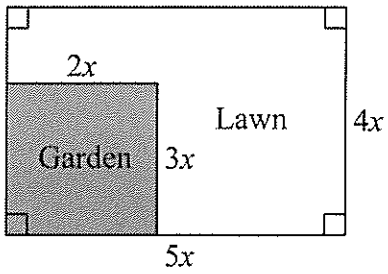
25 Find the value of y in the formula $y = mx + b$ if $m = -4$, $x = 10$ and $b = 6$. **1**

26 Solve the equation $5(a+3) = 4(a+4)$. **1**

27 Evaluate $3^2 \times (4 + 1^0) + 1$. **1**

28 Contestants win a prize by selecting a box. One box has a holiday, three boxes have cash prizes and the remainder have no prize. There are sixteen boxes. What is the probability of winning no prize? **1**

29 The diagram below shows a proposed garden and lawn area.



Not to scale

(i) Find an equation for the area of the lawn in terms of x **1**

(ii) Calculate the value of x required to provide a lawn area of 56 square metres? **1**

30 Factorise and simplify **2**

$$\frac{x^2 + 3x + 2}{x + 2}$$

31 Define rational numbers and give an example. **1**

32 Simplify **2**

$$\frac{(2a^3b^2)^2 \times 16a^7b}{(2a^2b)^5}$$

33 Expand **1**

$$(5k+4)^2$$

34 Simplify **2**

$$\frac{2x+1}{3} - \frac{x-5}{6} + \frac{x+4}{4}$$

35 Solve by forming and then solving a linear equation. **2**
Three less than four times a certain number is equal to 21. Find the number.

36 Solve by factorising **2**

$$5t^2 - 13t - 6 = 0$$

37 Solve by forming and then solving a quadratic equation. **2**
Find a positive integer that, when increased by 30, is 12 less than its square.

38 Simplify fully: **2**

$$\sqrt{45} + \sqrt{80} - \sqrt{125}$$

39 Simplify fully: **1**

$$(3 - \sqrt{7})(3 + \sqrt{7})$$

40 Rewrite this fraction with a rational denominator **1**

$$\frac{3\sqrt{7}}{\sqrt{2}}$$

41 Find $g(-a)$ for the function $g(x) = x^2 - 3x$ **1**

42 Given that $P(x) = x^2 - 2x - 4$, find the value of $P(\sqrt{2})$ **1**

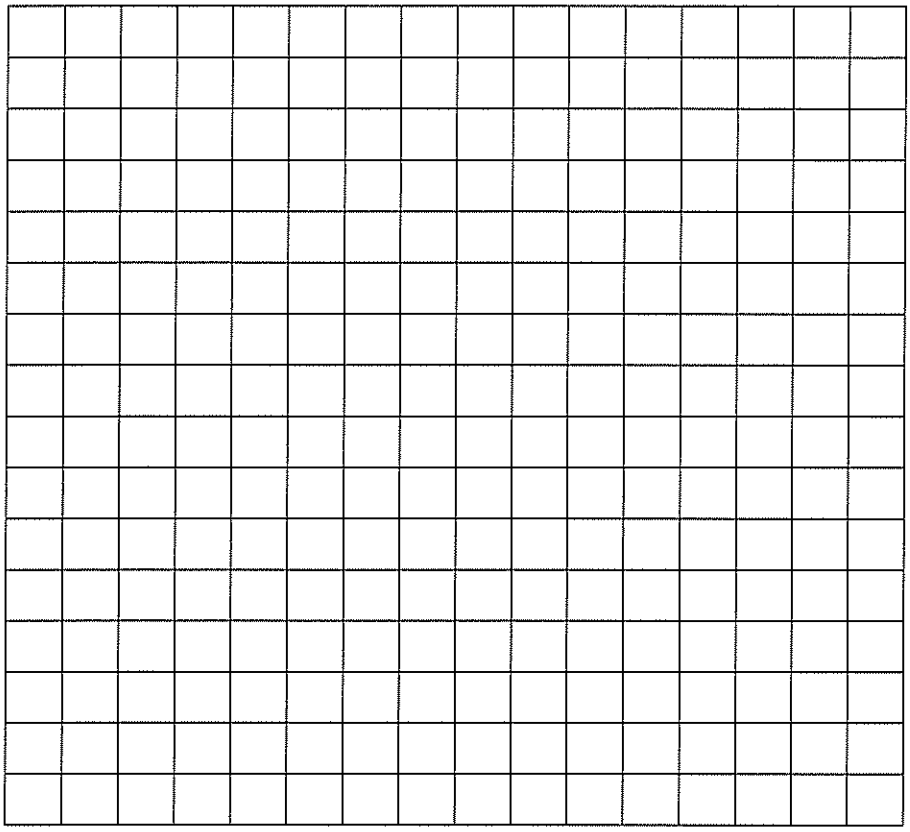
43 For the parabola $y = -(x + 2)(x - 4)$

(i) Find the x intercepts **1**

(ii) Find the y intercept **1**

(iii) Find the coordinates of the vertex **2**

(iv) Sketch the function **2**



44 A circle has equation

$$x^2 + (y - 3)^2 = 49$$

(i) Find the coordinates of the centre and the radius **1**

(ii) State the domain and range of the circle in interval notation **1**

45 A hyperbola has equation

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

(i) Complete the following table of values **1**

x	-4	-2	-1	$-\frac{1}{2}$	$\frac{1}{2}$	1	2	4
y								

(ii) State the equations of the two asymptotes of the hyperbola **1**

(iii) State the domain and range of the function **1**

46 Write down the new equation for the function $y = 2^x$ is translated down 3 units. **1**

47 Solve the inequation **1**

$$12 - 7x \geq -2x - 18$$

48 A circle with centre $(4, 5)$ passes through the origin. What is its radius? **2**

49 The points $A(-1,10), B(1,0), C\ (0,\sqrt{3})$ form a triangle. By finding the side lengths, determine if the triangle is **2**

(a) isosceles → has two equal sides

(b) equilateral → has three equal sides

(c) scalene → no equal sides

50 The points $A(2,5), B(4,11), C(12,15)$ and $D(10,9)$ form a quadrilateral. Find the gradients of AB and DC, and hence show that $AB \parallel DC$. **2**

51 Find the equation of the line that passes through $(-9,-1)$ and $(0,-4)$. Give your final answer in general form. **2**

52 Find, in gradient-intercept form, the equation of the line through $(2, 5)$ and perpendicular to $y = 2x + 5$. **2**

53 Expand **1**

$$\left(\frac{a^3}{3b}\right)^4$$

54 Write as a fraction without a negative index **1**

$$(3a^4)^{-2}$$

55 Rewrite this expression, using surds instead of fractional indices **1**

$$3x^{\frac{3}{2}}$$

56 Find the discriminant of the quadratic $y = x^2 - 4x + 1$ **1**

57 From observation of the equation of the quadratic in Q 56 and its discriminant, circle if the following is true or false. **2**

The roots are equal	True / False
The function is concave up	True / False
The function cuts the y-axis at -1	True / False
The function cuts the x-axis at integers	True / False

58 A stone is thrown upwards so that at any time t seconds after throwing, the height of the stone is $h = 100 + 10t - 5t^2$ metres.

(i) Find the time at which the stone reaches its maximum height. **2**

(ii) Hence find the maximum height reached. **1**

(iii) Assuming the stone lands on the ground, state the range for this scenario and explain the limitations. **2**

59 Use completion of the square to determine the centre and radius of the circle with equation **3**

$$x^2 - 10x + y^2 + 8y + 32 = 0$$

60 For the function $f(x) = 3^x$, state what happens as x approaches ∞ and $-\infty$. Explain why the function is always greater than zero. **2**

End of test

NESA NUMBER

NBCS
NORTHERN BEACHES CHRISTIAN SCHOOL

Year 10 5.3 Mathematics

2019 Yearly

MCQ M. Haughney.

General Instructions

- Reading time – 5 minutes
- Working time – 90 minutes
- Write using blue/black pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used

Total marks: 90

2019 Year 10 5.3 Mathematics Yearly Examination
Section I – Multiple Choice Answer Sheet

NESA Student Number MCQ M. Haughney

Allow about 30 minutes for this section

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

1.	A ●	B ○	C ○	D ○	A
2.	A ○	B ○	C ○	D ●	D
3.	A ●	B ○	C ○	D ○	A
4.	A ●	B ○	C ○	D ○	A
5.	A ○	B ●	C ○	D ○	B
6.	A ○	B ○	C ●	D ○	C
7.	A ○	B ●	C ○	D ○	B
8.	A ○	B ●	C ○	D ○	B
9.	A ○	B ○	C ●	D ○	C
10.	A ○	B ○	C ●	D ○	C
11.	A ○	B ●	C ○	D ○	B
12.	A ○	B ○	C ●	D ○	C
13.	A ○	B ●	C ○	D ○	B
14.	A ○	B ●	C ○	D ○	B
15.	A ○	B ●	C ○	D ○	B
16.	A ○	B ○	C ●	D ○	C
17.	A ○	B ○	C ●	D ○	C
18.	A ○	B ○	C ●	D ○	C
19.	A ●	B ○	C ○	D ○	A
20.	A ○	B ○	C ●	D ○	C

Section I

20 marks
Attempt Questions 1 - 20
Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1-20

---

1 What is the value of $\frac{2.4+3.6}{11.5+2.1}$? Answer correct to two decimal places.

(A) 0.44
(B) 2.62
(C) 2.66
(D) 4.81

2 Simplify $8x+3y-4x-7y$.

(A) $4x+10y$
(B) $4x+4y$
(C) $4x-10y$
(D) $4x-4y$

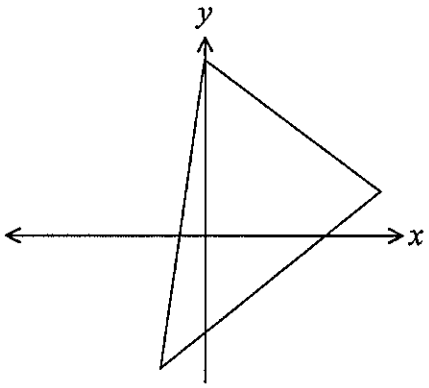
3 What is the probability of throwing a number less than 1, in a single throw of one die?

(A) 0
(B) $\frac{1}{5}$
(C) $\frac{1}{6}$
(D) 1

4 Which one of the following fractions lies between $\frac{1}{4}$ and $\frac{3}{4}$?

(A) $\frac{3}{5}$
(B) $\frac{5}{6}$
(C) $\frac{8}{9}$
(D) $\frac{9}{8}$

5 The diagram shows a triangle drawn on a number plane.



Which of these coordinate points could be a vertex of the triangle?

(A) (–1, 0)
(B) (0, 4)
(C) (4, –2)
(D) (5, 0)

6 A speed camera recorded the following speeds (km/h) of eight motor vehicles.

43, 51, 55, 55, 57, 58, 59, 78

Which of the following is true?

(A) Mean is 56 km/h
(B) Median is 57 km/h
(C) Mode is 55 km/h
(D) Range is 58 km/h

7 Expand $-2x(x-1)$.

(A) $-4x-2$
(B) $-4x+2x$
(C) $-2x^2+2$
(D) $-2x^2+2x$

8 Which of the following algebraic expressions is equivalent to $\frac{1}{4}+\frac{x}{8}$?

(A) $\frac{1+x}{8}$
(B) $\frac{2+x}{8}$
(C) $\frac{1+x}{12}$
(D) $\frac{8+x}{32}$

9 If $f(x) = x^2 - 2x$, give an expression for $f(x+2) - f(1)$.

(A) $x^2 + 2x$

(B) $x^2 + 6x - 1$

(C) $x^2 + 2x + 1$

(D) $x^2 + 2x - 8$

$= \left[(x+2)^2 - 2(x+2)\right] - \left[(1)^2 - 2(1)\right]$

$= x^2 + 4x + 4 - 2x - 4 - 1 + 2$

$= x^2 + 2x + 1$

10 The equation of the parabola $y = x^2 - 8x + 18$ may be written in the form:

(A) $y = (x-4)^2 + 34$

(B) $y = (x+4)^2 + 2$

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

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

$\left(\frac{-8}{2}\right)^2 = (-4)^2 = 16$

$y = (x^2 - 8x + 16) + 18 - 16$

$\Rightarrow (x-4)^2 + 2$

11 The coordinates of the points where $y = x^2 - 9$ cuts the x axis are:

(A) $(0, -3)$ and $(0, 3)$

(B) $(-3, 0)$ and $(3, 0)$

(C) $(-9, 0)$ and $(9, 0)$

(D) $(0, -9)$ and $(0, 9)$

$x^2 - 9 = 0$

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

$x = -3, \; x = 3$

$(-3, 0) \quad (3, 0)$.

12 The graph given by $y = 2^{x-2} + 1$ would be:

(A) a circle

(B) a hyperbola

(C) an exponential

(D) a parabola

13 The graph of a hyperbola has the equation $y = \frac{1}{x-1} + 2$. The asymptotes of the graph are:

(A) $x = 2, y = 1$

(B) $x = 1, y = 2$

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

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

14 The gradient of the line $2x + 3y - 36 = 0$ is:

(A) $-\frac{3}{2}$

(B) $-\frac{2}{3}$

(C) $\frac{2}{3}$

(D) $\frac{3}{2}$

$-\frac{2}{3}$

15 The distance between $A(4,-2)$ and $B(-3,5)$ is

(A) $\sqrt{10}$

(B) $\sqrt{98}$

(C) 10

(D) $\sqrt{198}$

16 The equation of the line parallel to $y = 4x - 1$ and has an x intercept -3 is:

(A) $y = 4x - 3$

(B) $y = -4x - 3$

(C) $y = 4x + 12$

(D) $y = -4x - 12$

$(-3,0)$ $m=4$

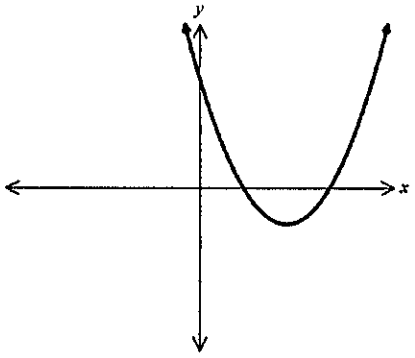
$x, y,$

$y - 0 = 4(x - -3)$

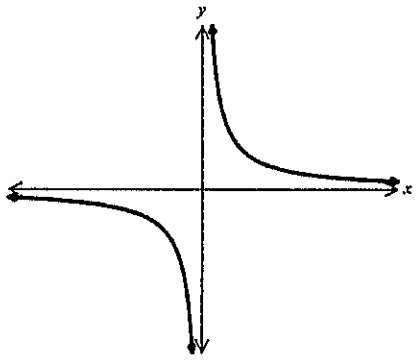
$y = 4x + 12$

17 Which graph does not represent a function?

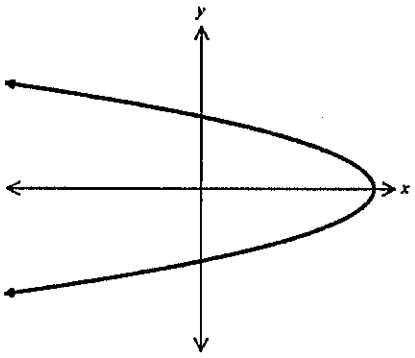
(A)



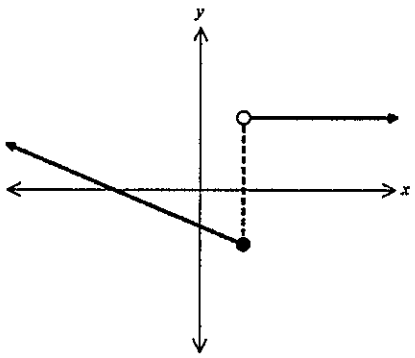
(B)



(C)



(D)



18 A letter is chosen from the word MATHEMATICS. The probability that the letter is neither M or A is:

(A) $\frac{2}{11}$

(B) $\frac{4}{11}$

(C) $\frac{7}{11}$

(D) $\frac{9}{11}$

19 The function $y = -x^2 - 3$ is:

(A) concave down and vertically translated down 3 units

(B) concave down and vertically translated up 3 units

(C) concave up and vertically translated down 3 units

(D) concave up and vertically translated up 3 units

20 $9a^4 - 1$ is:

(A) a perfect square

(B) a cubic

(C) the difference of two squares

(D) not a function

End of Multiple Choice Questions

P. Haras

Section II

70 marks
Attempt Questions 21 – 60
Allow about 60 minutes for this section

Answer the questions in the spaces provided.

All necessary working should be shown in every question.

---

21 Solve the equation $2x+4=9$. (1)

$2x = 5$

$x = 5/2$

ANS ONLY ✓
NO HALF MARKS

22 The results of a class test are shown in the box-and-whisker plot below.



(i) What is the range? (1)

$70 - 33 = 37$

ANS ONLY
NO HALF MARKS

(ii) What is the interquartile range? (1)

$60 - 42 = 18$

ANS ONLY
NO HALF MARKS

23 Ebony goes to a shop that sells vanilla, chocolate, strawberry and rainbow ice creams. She decides to buy two ice creams, each one a different flavour. How many different choices are possible? (1)

$4 \times 3 = 12$

ANS ONLY
NO HALF MARKS.

4

24 What is the mode of the data in the following stem-and-leaf plot? (1)

2	1 6 7 8 9
3	1 1 1 3 4 4 7 7
4	0 2 3 4 6 6 9 9
5	1 4 5 8

Key: 2|1 = 21

ANS ONLY NO HALF MARKS

Mode = 31

1

25 Find the value of y in the formula $y = mx + b$ if $m = -4$, $x = 10$ and $b = 6$. (1)

$y = (-4)(10) + (6)$

$= -40 + 6$

$= -34$

ANS ONLY ✓

HALF MARK FOR CORRECT SUB. BUT CALC. ERROR

26 Solve the equation $5(a+3) = 4(a+4)$. (1)

$5a + 15 = 4a + 16$ (½) EXPANSION FULLY CORRECT

$a = 1$ (½) ANS

27 Evaluate $3^2 \times (4 + 1^0) + 1$. (1)

$= 46$

ANS ONLY NO HALF MARKS

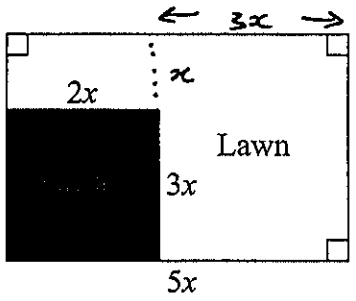
28 Contestants win a prize by selecting a box. One box has a holiday, three boxes have cash prizes and the remainder have no prize. There are sixteen boxes. What is the probability of winning no prize? (1)

$16 - 1 - 3 = 12$ (½) FOR FINDING 12.

$P(\text{no prize}) = \frac{12}{16} = \frac{3}{4}$ (½) FOR PROB.

/5

29 The diagram below shows a proposed garden and lawn area.



Not to scale

(i) Find an equation for the area of the lawn in terms of x (1)

$\text{Lawn} = (3x)(4x) + (2x)(x)$ ($\frac{1}{2}$) FOR ATTEMPT TO FORM AN EXPRESSION THAT IS CORRECT STEP

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

$= 14x^2$ ($\frac{1}{2}$) FOR ANS.

OR $(5x)(x) + (3x)(3x)$

$= 5x^2 + 9x^2 = 14x^2$

(ii) Calculate the value of x required to provide a lawn area of 56 square metres? (1)

$\text{Lawn} = 14x^2$ ($\frac{1}{2}$) LETTING (i) = 56 (POSSIBLE ECF)

$56m^2 = 14x^2$

$4 = x^2$ ($\frac{1}{2}$) CORRECT value for x given (incl. ECF)

$\pm 2 = x$

$x > 0 \quad \therefore \quad x = 2m$

IF STUDENTS DON'T WRITE THIS, PLEASE ADD IT TO THEIR SOLUTION AS FEEDBACK.

30 Factorise and simplify (2)

$$\frac{x^2 + 3x + 2}{x + 2}$$

$= \dfrac{(x+2)(x+1)}{(x+2)}$ ($\frac{1}{2}$) CORRECT FACTORISE

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

31 Define rational numbers and give an example. (1)

A rational number is any number that can be expressed as a fraction.

Eg. [ ] ($\frac{1}{2}$) EXPLANATION

($\frac{1}{2}$) EXAMPLE

/5

32 Simplify

$$\frac{(2a^3b^2)^2 \times 16a^7b}{(2a^2b)^5}$$

(2)

$= \frac{4a^6b^4 \times 16a^7b}{32a^{10}b^5} = 2a^3$

(1) CORRECT EXPANSION

(1) CORRECT SIMPLIFY

$(-\frac{1}{2})$ FOR FORGETTING $2^2=4$ and/or $2^5=32$

$(-\frac{1}{2})$ FOR NOT FULLY SIMPLIFIED

33 Expand

$$(5k+4)^2$$

$(\frac{1}{2})$

$= 25k^2 + 40k + 16$

(1): CORRECT ANS

$(\frac{1}{2})$ IF SHOWED $(5k+4)(5k+4)$ BUT MADE AN ERROR SUBSEQUENTLY.

* NO MARKS FOR: $25k^2 + 16$

34 Simplify

$$\frac{2x+1}{3} - \frac{x-5}{6} + \frac{x+4}{4}$$

(2)

(1) FOR CORRECT NUMERATOR + DENOMINATOR

$= \frac{4(2x+1) - 2(x-5) + 3(x+4)}{12}$

$= \frac{8x + 4 - 2x + 10 + 3x + 12}{12}$

$(\frac{1}{2})$ CORRECT EXPANSION

$= \frac{9x+26}{12}$

$(\frac{1}{2})$ CORRECT SIMPLIFY (POSSIBLE ECF)

35 Solve by forming and then solving a linear equation.
Three less than four times a certain number is equal to 21. Find the number.

(2)

$4x - 3 = 21$

$4x = 24$

$x = 6$

(1) SET UP EQUATION

(1) SOLUTION

/7

36 Solve by factorising (2)

$$5t^2 - 13t - 6 = 0$$

$5t^2 - 15t + 2t - 6 = 0$

$5t(t-3) + 2(t-3) = 0$ (1) USING ANY METHOD

$(5t+2)(t-3) = 0$

$5t+2=0 \quad t-3=0$

$5t = -2 \quad t = 3$ (½) FOR EACH CORRECT SOLN (POSSIBLE ECF)

$t = -2/5$

-½ for +15 -2

37 Solve by forming and then solving a quadratic equation. (2)

Find a positive integer that, when increased by 30, is 12 less than its square.

$x + 30 = x^2 - 12$ (½) SET UP EQUATION

$x^2 - x - 42 = 0$

$(x-7)(x+6) = 0$ (½) FACTORISE

$x = 7 \quad x = -6$ (½) TWO POSSIBLE VALUES

positive integer $\therefore x = 7$. (½) STATEMENT

2 ∴ if give 7 only.

38 Simplify fully: (2½) 1

$$\sqrt{45} + \sqrt{80} - \sqrt{125}$$

$= \sqrt{9}\sqrt{5} + \sqrt{16}\sqrt{5} - \sqrt{25}\sqrt{5}$

$= 3\sqrt{5} + 4\sqrt{5} - 5\sqrt{5}$

$= 2\sqrt{5}$

-1 not fully simp.

39 Simplify fully: (1)

$$(3-\sqrt{7})(3+\sqrt{7})$$

$= (3)^2 - (\sqrt{7})^2$

$= 9 - 7$

$= 2$

1

17

40 Rewrite this fraction with a rational denominator (1)

$$\frac{\frac{3\sqrt{7}}{\sqrt{2}}}{}$$

$\frac{3\sqrt{7}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{3\sqrt{14}}{2}$

41 Find $g(-a)$ for the function $g(x) = x^2 - 3x$ (1)

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

$= a^2 + 3a$

42 Given that $P(x) = x^2 - 2x - 4$, find the value of $P(\sqrt{2})$ (1)

$P(\sqrt{2}) = (\sqrt{2})^2 - 2(\sqrt{2}) - 4$

$= 2 - 2\sqrt{2} - 4$

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

43 For the parabola $y = -(x+2)(x-4)$

(i) Find the x intercepts (1)

x int @ $y=0$ $\therefore$ $0 = -(x+2)(x-4)$

$0 = (x+2)(x-4)$

$x = -2, \quad x = 4$

$(-2, 0) \quad (4, 0)$

(ii) Find the y intercept (1)

y int @ $x=0$ $\therefore$ $y = -(0+2)(0-4)$

$= 8$ $(0, 8)$

(iii) Find the coordinates of the vertex (2)

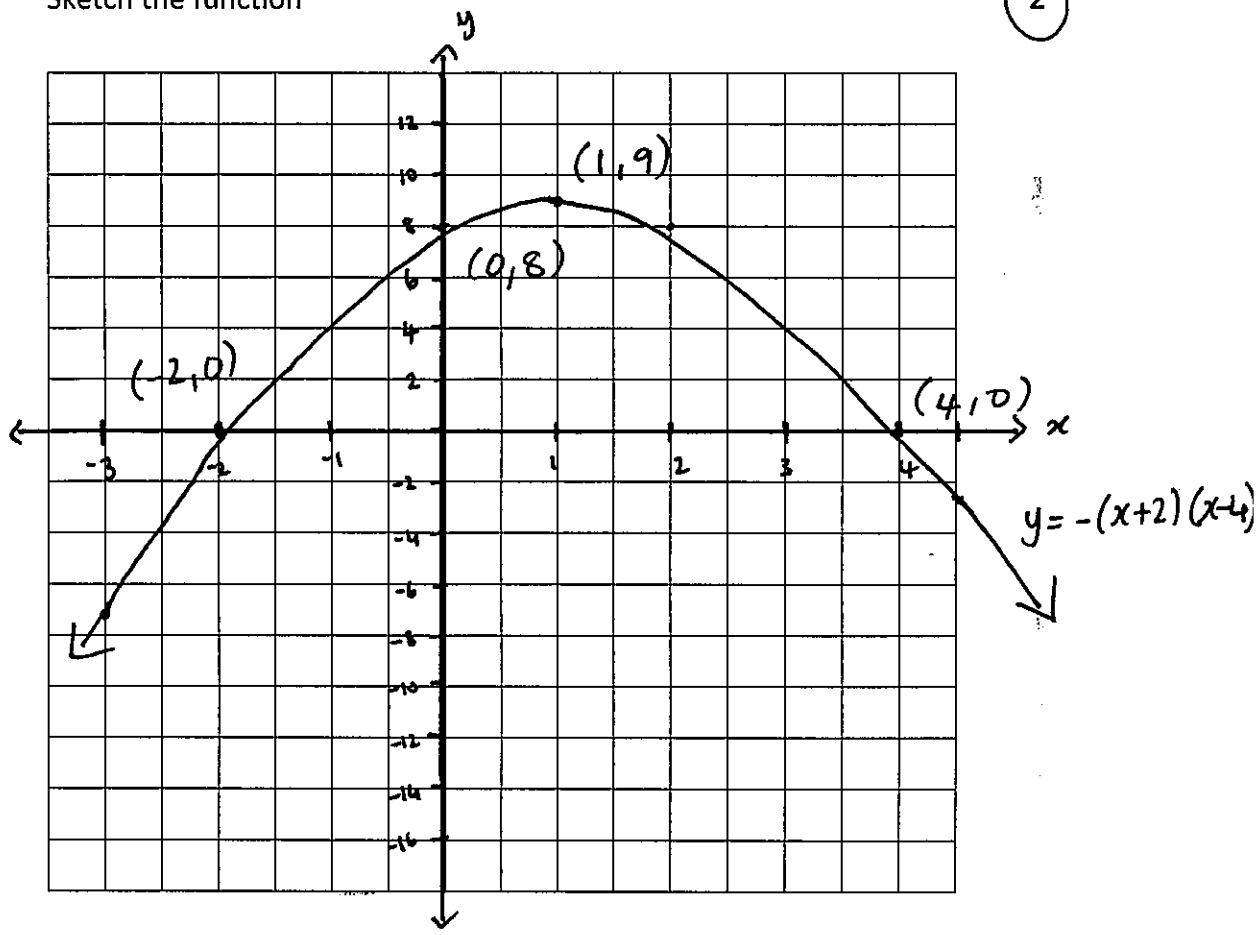
vertex @ $x = \frac{-2+4}{2} = 1$

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

$= +9$ Vertex $(1, +9)$

17

(iv) Sketch the function **2**

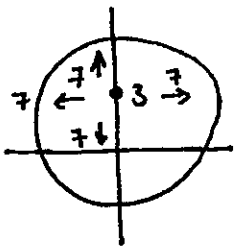


(-2,0) (4,0) (0,8) (1,-9)

44 A circle has equation

$$x^2 + (y-3)^2 = 49$$

(i) Find the coordinates of the centre and the radius **1**



Centre (0,3)
Radius 7

(ii) State the domain and range of the circle in interval notation **1**

Domain [-7,7] Range [-4,10]

4

45 A hyperbola has equation

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

(i) Complete the following table of values (1)

x	-4	-2	-1	$-\frac{1}{2}$	$\frac{1}{2}$	1	2	4
y	$-\frac{1}{2}$	-1	-2	-4	4	2	1	$\frac{1}{2}$

(ii) State the equations of the two asymptotes of the hyperbola (1)

accept without "vertical" "horizontal"

vertical: $x = 0$ ($\frac{1}{2}$) and horizontal: $y = 0$ ($\frac{1}{2}$)

(iii) State the domain and range of the function (1)

must indicate R: for (−½ mark) marks.

Domain: all real x, $x \neq 0$ ($\frac{1}{2}$) or $x<0, x>0$; $(-\infty,0) \cup (0,\infty)$

Range: all real y, $y \neq 0$ ($\frac{1}{2}$) or $y<0, y>0$ or $(-\infty,0) \cup (0,\infty)$

46 Write down the new equation for the function $y = 2^x$ is translated down 3 units. (1)

~~1/2 mark~~

$y = 2^x - 3$

47 Solve the inequation (1)

$$12 - 7x \geq -2x - 18$$

$12 + 18 \geq -2x + 7x$ | $-7x + 2x \geq -18 - 12$

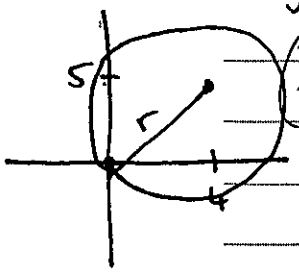
$30 \geq 5x$ | $-5x \geq -30$

$6 \geq x$ | $x \leq 6$

1

48 A circle with centre $(4, 5)$ passes through the origin. What is its radius? (2)

$(0,0)$ x_1, y_2 $\quad$ $x_2 y_2$



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ ($\frac{1}{2}$) OR $(x-4)^2 + (y-5)^2 = r^2$ ($\frac{1}{2}$)

$= \sqrt{(4-0)^2 + (5-0)^2}$ ($\frac{1}{2}$) $(-4)^2 + (-5)^2 = r^2$ ($\frac{1}{2}$)

$= \sqrt{(4)^2 + (5)^2}$ ($\frac{1}{2}$) $41 = r^2$ ($\frac{1}{2}$)

radius $= \sqrt{41}$ ($\frac{1}{2}$) $\sqrt{41} = r$ ($\frac{1}{2}$)

any ster $r^2 = a$, $r = \sqrt{a}$ ect ($\frac{1}{2}$)

/7

49 The points $A(-1,10), B(1,0), C(0,\sqrt{3})$ form a triangle. By finding the side lengths, determine if the triangle is (2)

(a) isosceles → has two equal sides

(b) equilateral → has three equal sides

(c) scalene → no equal sides

$AB = \sqrt{(1+1)^2+(0-10)^2} = \sqrt{104}$ ½

$BC = \sqrt{(0-1)^2+(\sqrt{3}-0)^2} = \sqrt{4}$ ½

$AC = \sqrt{(0+1)^2+(\sqrt{3}-10)^2}$ ½ $= \sqrt{104 - 20\sqrt{3}} = \sqrt{69.3589\ldots}$

$AB \neq BC \neq AC$

$\therefore \Delta ABC$ is scalene ½ with some evidence. (no equal sides)

50 The points $A(2,5), B(4,11), C(12,15)$ and $D(10,9)$ form a quadrilateral. Find the gradients of AB and DC, and hence show that $AB \parallel DC$. (2)

$m_{AB} = \frac{11-5}{4-2} = 3$ (½)

$m_{DC} = \frac{9-15}{10-12} = 3$ (½)

$m_{AB} = m_{DC} \therefore AB \parallel DC$ (½) (½)

51 Find the equation of the line that passes through $(-9,-1)$ and $(0,-4)$. Give your final answer in general form. (2)

$m = \frac{-4+1}{0+9} = -\frac{1}{3}$ (½)

$y = -\frac{1}{3}x + c$ (½)

$-4 = -\frac{1}{3}(0) + c$ (½)

$\therefore y = -\frac{1}{3}x - 4$ (½)

$y - y_1 = m(x - x_1)$

$y + 1 = -\frac{1}{3}(x+9)$ (½)

$3(y+1) = -1(x+9)$

$3y + 3 = -x - 9$

$x + 3y + 3 + 9 = 0$

$x + 3y + 12 = 0$ (½) (1)

or $y = -\frac{1}{3}x - 4$

(½) answer in general

(½) correct answer.

y=mx+c form

16

52 Find, in gradient-intercept form, the equation of the line through (2, 5) and perpendicular to $y = 2x + 5$. (2)

$m_1 = 2 \quad \frac{1}{2} \perp m_2 = -\frac{1}{2}$ $\quad y - y_1 = m(x - x_1)$

$y - 5 = -\frac{1}{2}(x - 2)$ $\frac{1}{2}$

$y - 5 = -\frac{1}{2}x + 1$

$y = -\frac{1}{2}x + 6$ $\frac{1}{2}$

53 Expand (1)

$$\left(\frac{a^3}{3b}\right)^4$$

$\frac{a^{12}}{81b^4}$ ✓✓ $\qquad \frac{a^{12}}{3+b^4}$ $\frac{1}{2}$ only

54 Write as a fraction without a negative index (1)

$$(3a^4)^{-2}$$

$\frac{1}{(3a^4)^2} = \frac{1}{9a^8}$ no $\frac{1}{2}$ marks. accept either.

55 Rewrite this expression, using surds instead of fractional indices (1)

$$3x^{\frac{3}{2}}$$

correct answer

11

$= 3\sqrt{x^3}$ no $\frac{1}{2}$ mark.

56 Find the discriminant of the quadratic $y = x^2 - 4x + 1$ (1)

$a = 1 \quad b = -4 \quad c = 1$ $\frac{1}{2}$

$\Delta = b^2 - 4ac$

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

$= 16 - 4$

$= 12$ $\frac{1}{2}$

1

$\Delta = \sqrt{12}$ $\frac{1}{2}$

1

1

7

6

57 From observation of the equation of the quadratic in Q 56 and its discriminant, circle if the following is true or false. (2)

The roots are equal	True / (False)	$\Delta \neq 0$
The function is concave up	(True) / False	$a > 0$
The function cuts the y-axis at -1	(True) / (False)	@ $x=0$, $y=1$
The function cuts the x-axis at integers	True / (False)	$\Delta \not\in$ Perfect square

58 A stone is thrown upwards so that at any time t seconds after throwing, the height of the stone is $h = 100 + 10t - 5t^2$ metres.

(i) Find the time at which the stone reaches its maximum height. (2)

x coordinate @ $\frac{-b}{2a}$ $a=-5, b=10, c=100$

$\therefore t = \frac{-(10)}{2(-5)} = 1$

@ $t=1$, $h = 100+10(1)-5(1)^2$

$= 105$

∴ after 1 second, the stone reaches it's maximum height @ 105m.

(ii) Hence find the maximum height reached. (1)

@ $t=1$, $h = 100 + 10(1) - 5(1)^2$

$= 105$

∴ after 1 second, the stone reaches its maximum height of 105m.

(iii) Assuming the stone lands on the ground, state the range for this scenario and explain the limitations. (2)

Range : $[0, 105]$

For this scenario, only positive values for h may be considered.

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

59 Use completion of the square to determine the centre and radius of the circle with equation (3)

$$x^2 - 10x + y^2 + 8y + 32 = 0$$

$(x^2 - 10x + 25) + (y^2 + 8y + 16) = -32 + 25 + 16$

$(x-5)^2 + (y+4)^2 = 9$

$\therefore$ Centre: $(5, -4)$

Radius: 3

60 For the function $f(x) = 3^x$, state what happens as x approaches ∞ and $-\infty$. Explain why the function is always greater than zero. (2)

For $x \to \infty$, $f(x) \to \infty$

For $x \to -\infty$, $f(x) \to 0$

The range for this function is greater than zero. There are no possible values for x that will output a negative y value or $y=0$.

End of test

5