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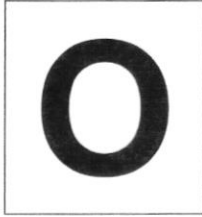
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NORTHBROOKS SECONDARY SCHOOL
End-of-Year Examination 2022
Secondary 2 Express



CANDIDATE
NAME

CLASS

REGISTER
NUMBER

MATHEMATICS

4052/01

Paper 1 ---

7 October 2022

1 hour 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your register number, name and class on all the work you hand in.
 Write in dark blue or black pen.
 You may use an HB pencil for any diagrams or graphs.
 Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

The number of marks is given in brackets [] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The total of the marks for this paper is 50.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

FOR EXAMINER'S USE											
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	
											50

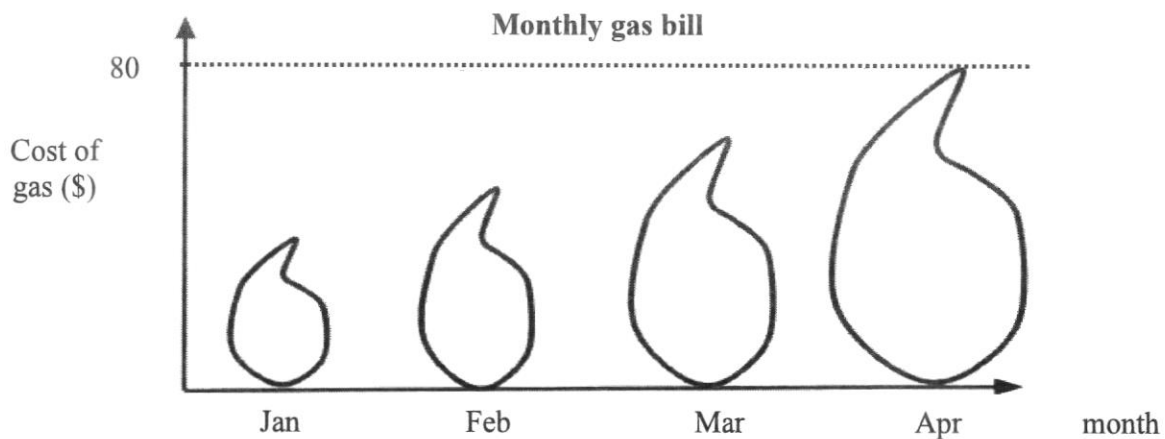
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Setter: Ms Joanna Ho

Answer **all** the questions.

- 1 The graph shows the monthly gas bill for a household in Singapore.



- (a) State one aspect of the graph that may be misleading.

Answer

[1]

- (b) Explain how this may lead to a misinterpretation of the graph.

Answer

[1]

- 2 It takes 8 men to paint 2 houses in 4 days. Given that all the men work at the same rate, how many days would it take for 6 men to paint 3 houses?

Answer [3]

- 3 Factorise completely

(a) $12ax + 2by - 3ay - 8bx$,

Answer [2]

(b) $2x^2 - 7x - 15$.

Answer [1]

4 (a) Simplify $(a+b)^2 - (a+b)(a-b)$.

Answer [2]

(b) Hence find the exact value of $1012^2 - 1012 \times 988$ **without using a calculator**.

Answer [2]

- 5 (a) Given that $T = 2\pi\sqrt{\frac{m}{k}}$, express m in terms of T and k .

Answer $m = \dots\dots\dots$ [2]

- (b) Hence find the value of m when $T = 4$ and $k = 5$.
Give your answer correct to 4 significant figures.

Answer $m = \dots\dots\dots$ [2]

6 It is given that y is directly proportional to the cube of $(x + 2)$ and that $y = 4$ when $x = 2$.

(a) Express y in terms of x .

Answer $y = \dots\dots\dots$ [2]

(b) Find the value of x when $y = 32$.

Answer $x = \dots\dots\dots$ [2]

7 A map is drawn to a scale of 1 : 20 000.

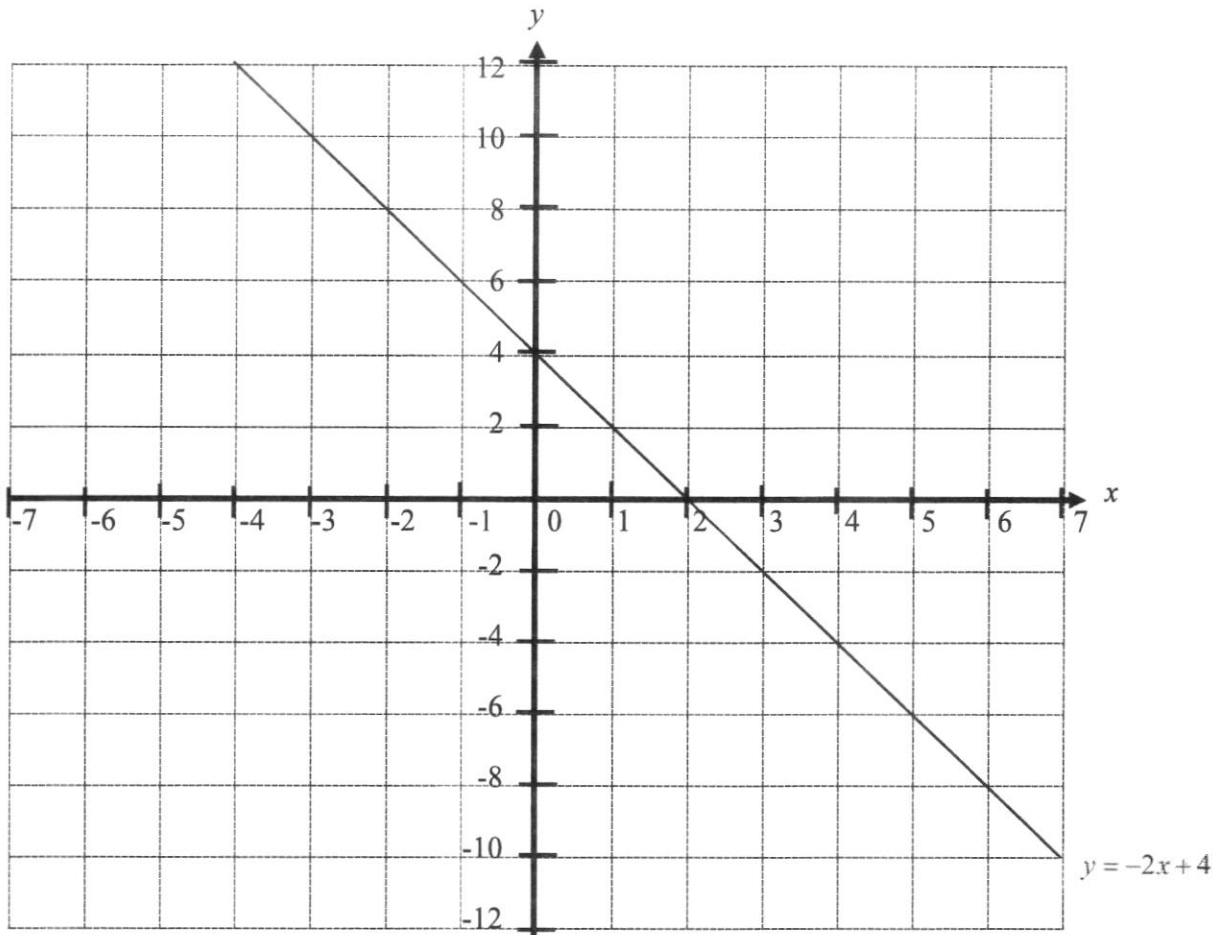
(a) If the actual perimeter of a school is 3600 m, find the perimeter of the school on the map.

Answer cm [2]

(b) If a plot of land has an area of 4.5 cm^2 on the map, find its actual area in square metres.

Answer m^2 [2]

8 The graph below shows the line $y = -2x + 4$.



(a) A student stated that the following simultaneous equations will have only one solution.

$$y = -2x + 4$$

$$3y = -6x + 12$$

Do you agree or disagree with the student? Explain.

Answer

..... [2]

(b) On the same grid, draw the line $x = -3$. [1]

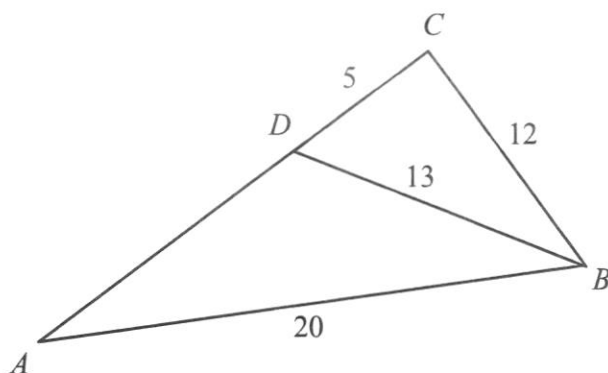
(c) Find the area of the triangle formed by the lines $x = -3$, $y = -2x + 4$ and the x -axis.

Answer units² [2]

- 9 There are some cows and chickens on a farm.
The animals have a total of 35 heads and 110 legs.
By forming simultaneous equations, calculate how many more cows than chickens there are.

Answer [5]

- 10 $ABCD$ is a plot of land such that $AB = 20$ m, $BC = 12$ m, $CD = 5$ m and $DB = 13$ m.



- (a) Show that angle $BCD = 90^\circ$.

Answer

[2]

- (b) Calculate angle CAB .

Answer angle $CAB = \dots\dots\dots$ [2]

(c) Find the length AD .

Answer m [2]

11 Kelly is planning an expedition. She explores two possible routes.

- (a)** If she travels on route A, which is 150 km long, she expects to cover $2x$ km per hour. Route B, which is 52 km long, has more challenging terrain and she would only be able to cover $(x - 2)$ km per hour.

Write down an expression, in terms of x , for the time, in hours, she expects to take on

- (i)** route A,

Answer hours [1]

- (ii)** route B.

Answer hours [1]

- (b)** She estimates that route A will take 30 minutes less than route B.

Write down an equation in x to represent this information and show that it reduces to

$$x^2 + 44x - 300 = 0.$$

Answer

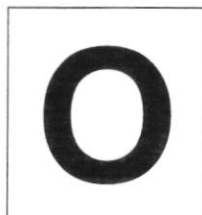
[3]

- (c) Solve the equation $x^2 + 44x - 300 = 0$.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [3]

- (d) Calculate the time, in hours, that she expects to take on route B.

Answer $\dots\dots\dots$ hours [2]



NORTHBROOKS SECONDARY SCHOOL
End-of-Year Examination 2022
Secondary 2 Express



CANDIDATE NAME	
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CLASS		REGISTER NUMBER			
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MATHEMATICS**4052/02**

Paper 2 --

5 October 2022**1 hour 15 minutes**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your register number, name and class on all the work you hand in.
 Write in dark blue or black pen.
 You may use an HB pencil for any diagrams or graphs.
 Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

The number of marks is given in brackets [] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The total of the marks for this paper is 50.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

FOR EXAMINER'S USE										
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	
										50

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This document consists of 13 printed pages.

Setter: Ms Kerina Tan

1 (a) Solve $\frac{3x-10}{5} \geq \frac{2(x-5)}{3}$.

Answer [3]

(b) Hence state the largest prime number that satisfies the inequality $\frac{3x-10}{5} \geq \frac{2(x-5)}{3}$.

Answer [1]

2 A box contains 2 red crayons, 7 blue crayons and 11 yellow crayons.

One crayon is drawn from the box.

(a) Find the probability that

(i) the crayon is red,

Answer [1]

(ii) the crayon is either blue or yellow.

Answer [1]

(b) x more blue crayons were added to the box.

The probability of drawing a blue crayon is now $\frac{1}{2}$.

Find the value of x .

Answer $x =$ [2]

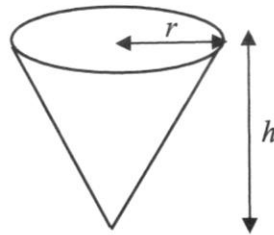
- 3 Samantha has 3 cards labelled 29, 30 and 35.
 She has another 3 cards labelled A , B and C , where A , B and C are whole numbers.
 The mean and median of the six cards is 31.5 and 31 respectively.
 The mode is an even number.
 Given that $A < B < C$, find the values of A , B and C .

Answer $A = \dots\dots\dots$ [1]

$B = \dots\dots\dots$ [1]

$C = \dots\dots\dots$ [1]

- 4 The diagram shows cone A which has a volume of 400 cm^3 . Cone A has radius r cm and height h cm.



Another cone, cone B , has a radius that is 150% that of cone A and a height that is 50% that of cone A . Find the capacity of cone B .

Answer $\dots\dots\dots \text{cm}^3$ [2]

5 The test marks of 20 students are recorded in the table.

25	18	10	29	22
11	15	19	15	23
6	24	28	16	18
22	30	15	19	4

(a) Construct a stem-and-leaf diagram to represent this set of data.

Answer

Stem	Leaf
0	
1	
2	
3	

Key:

[2]

(b) Find the median mark.

Answer [2]

(c) One more student who received 21 marks is added to the data above.
Find the new median mark.

Answer [1]

6 (a) Simplify $\frac{a^2 - a}{a}$.

Answer [2]

(b) Write as a single fraction in its simplest form $\frac{3x^2y^2z^3}{(5yz^2)^2} \div \frac{27x^2y}{20y^2z}$.

Answer [3]

(c) Write as a single fraction in its simplest form $\frac{2}{m+2} - \frac{6(m-1)}{m^2-4}$.

Answer [3]

- 7 A solid metal sphere has a total surface area of 9162 cm^2 .
- (a) Show that the radius of the solid metal sphere is 27 cm, correct to the nearest integer.

Answer

[3]

- (b) The solid metal sphere is melted and then moulded into hemispheres of radius 3 cm each.
Find the number of hemispheres that can be moulded.

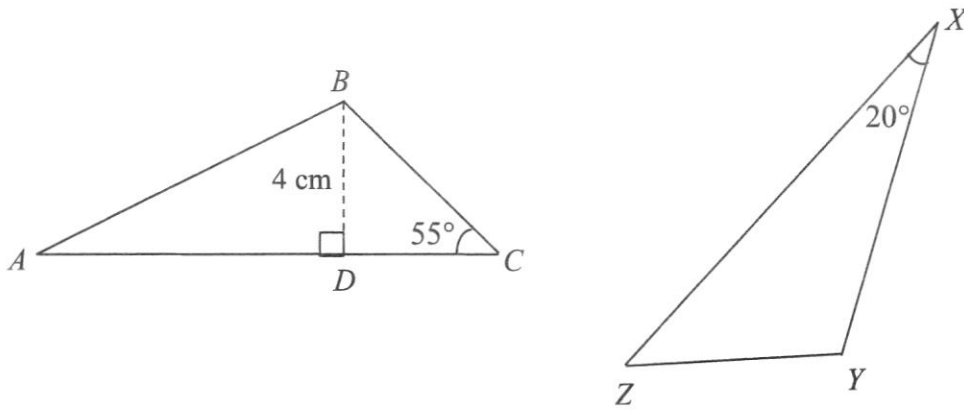
Answer [3]

- (c) It costs \$0.40 to paint 1 cm^2 of a hemisphere.
Samuel wants to paint the entire surface of each hemisphere.
He claims that he can paint the surfaces of all the hemispheres within a budget of \$49 000.
Justify why his claim is incorrect.

Answer

[3]

8 Triangle ABC is congruent to triangle XYZ .



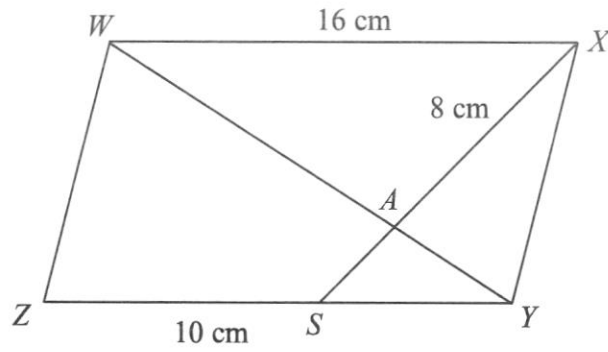
(a) Find angle XYZ .

Answer angle $XYZ = \dots\dots\dots$ [1]

(b) If the perpendicular distance from B to AC is 4 cm, find XZ .

Answer $XZ = \dots\dots\dots$ cm [3]

- 9 $WXYZ$ is a parallelogram. The point S lies on the line YZ . The line WY cuts the line XS at A .
 $WX = 16$ cm, $XA = 8$ cm and $ZS = 10$ cm.
Triangle WAX is similar to triangle YAS .



Show that $AS = 3$ cm.

Answer

[3]

- 10** The variables x and y are connected by the equation $y = 2x^2 - 2x - 4$.
Some corresponding values of x and y are given in the table below.

x	-2	-1	0	1	2	3
y	8	a	-4	-4	0	b

- (a) Find the values of a and b .

Answer $a = \dots\dots\dots$

$b = \dots\dots\dots$ [2]

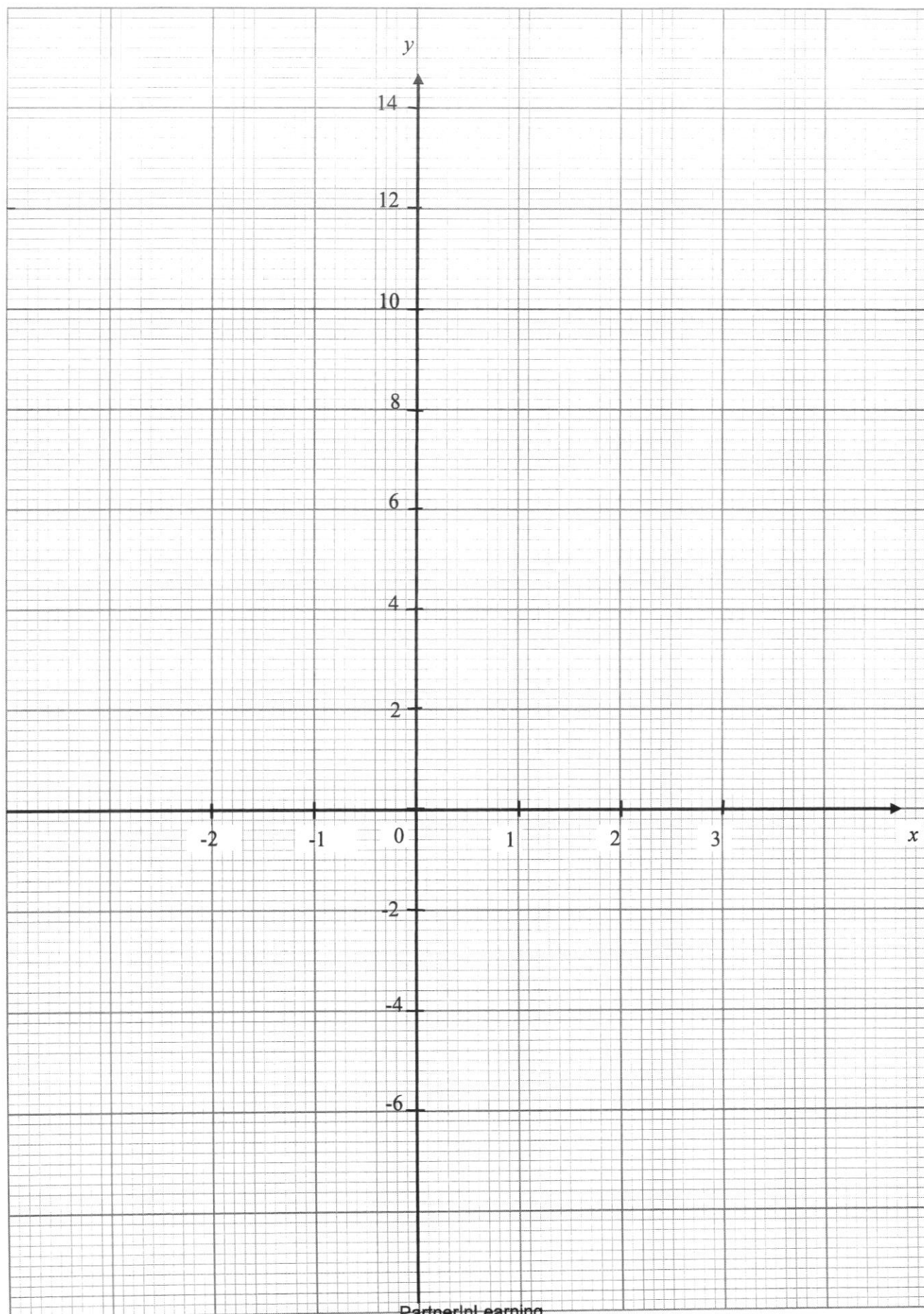
- (b) On the grid on page 13, draw the graph of $y = 2x^2 - 2x - 4$ for $-2 \leq x \leq 3$. [3]

- (c) Use your graph to find the values of x when $y = 4$.

Answer $x = \dots\dots\dots$ and $\dots\dots\dots$ [2]

- (d) State the equation of the line of symmetry of the graph of $y = 2x^2 - 2x - 4$.

Answer $\dots\dots\dots$ [1]



NORTHBROOKS SECONDARY SCHOOL
 MATHEMATICS DEPARTMENT
 2 EXPRESS
 MATHEMATICS

END OF YEAR PAPER 1 MARKING SCHEME 2022

1a	Misleading: It is not certain whether to use the height of the "gas" or the area of the "gas" to compare the value.	B1
1b	Explanation: Readers might misinterpret that February gas bill is less than half that of April due to the area of the "gas".	B1 Accept any relevant explanation
2	8 men to paint 2 houses in 4 days 1 man to paint 2 houses in 32 days 6 men to paint 2 houses in $\frac{32}{6}$ days 6 men to paint 1 house in $\frac{32}{12}$ days 6 men to paint 3 houses in 8 days	M1 – direct proportion M1 – inverse proportion A1
3a	$12ax + 2by - 3ay - 8bx$ $= 12ax - 3ay + 2by - 8bx$ $= 3a(4x - y) - 2b(4x - y)$ $= (4x - y)(3a - 2b)$	M1 A1
3b	$2x^2 - 7x - 15$ $= (2x + 3)(x - 5)$	B1
4a	$(a + b)^2 - (a + b)(a - b)$ $= a^2 + b^2 + 2ab - a^2 + b^2$ $= 2b^2 + 2ab$	M1 A1

4b	$a = 1000, b = 12$ $2b^2 + 2ab$ $= 2(12)^2 + 2(1000)(12)$ $= 288 + 24000$ $= 24288$	M1 – substitution of a and b A1
5a	$T = 2\pi\sqrt{\frac{m}{k}}$ $\sqrt{\frac{m}{k}} = \frac{T}{2\pi}$ $\frac{m}{k} = \frac{T^2}{4\pi^2}$ $m = \frac{kT^2}{4\pi^2}$	M1- squaring both sides A1
5b	$m = \frac{kT^2}{4\pi^2}$ $= \frac{5(4^2)}{4\pi^2}$ $= 2.0264$ $= 2.026$	M1 – substitution of T and k A1
6a	$y = k(x+2)^2$ when $y = 4, x = 2,$ $4 = k(2+2)^2$ $k = \frac{4}{(2+2)^2}$ $= \frac{1}{16}$ $y = \frac{1}{16}(x+2)^2$	M1 – substitution of y and x A1

6b	$y = \frac{1}{16}(x+2)^2$ <p>when $y = 32$</p> $32 = \frac{1}{16}(x+2)^2$ $(x+2)^2 = 512$ $x+2 = 8$ $x = 6$	M1 – substitution of y A1
7a	1 cm : 200 m 18 cm : 3600 m	M1 A1
7b	1 cm : 200 m 1 cm ² : 40 000 m ² 4.5 cm ² : 180 000 m²	M1 – conversion to area scale A1
8a	Disagree. $y = -2x + 4$ and $3y = -6x + 12$ have infinite number of solutions because the two lines equations are identical .	B1 B1

8b	<p style="text-align: center;">$x = -3$</p> <p style="text-align: right;">$y = -2x + 4$</p>	B1
8c	$\frac{1}{2}(10)(5)$ $= 25$	M1 A1

9	<p>Let x be the number of cows on the farm.</p> <p>Let y be the number of chickens on the farm.</p> $x + y = 35 \quad (1)$ $4x + 2y = 110 \quad (2)$ <p>From (1):</p> $x = 35 - y \quad (3)$ <p>Sub (3) into (2)</p> $4(35 - y) + 2y = 110$ $140 - 4y + 2y = 110$ $-2y = -30$ $y = 15$ <p>sub $y = 15$ into (3)</p> $x = 35 - 15$ $x = 20$ <p>\therefore there are 5 more cows than chickens.</p>	<p>M1 – forming two equations</p> <p>M1- use of substitution or elimination</p> <p>A1</p> <p>A1</p> <p>A1</p>
10a	$DB^2 = 13^2$ $DB^2 = 169$ $CB^2 + DC^2 = 12^2 + 5^2$ $CB^2 + DC^2 = 169$ <p>By the <u>converse of pythagoras theorem</u>, triangle DCB is right angled because $DB^2 = CB^2 + DC^2$ with $\angle BCD = 90^\circ$.</p>	<p>M1 – show DB^2 and $CB^2 + DC^2$</p> <p>A1</p>
10b	$\sin \angle CAB = \frac{12}{20}$ $\angle CAB = \sin^{-1} \left(\frac{12}{20} \right)$ $= 36.870$ $= 36.9^\circ$	<p>M1</p> <p>A1</p>

10c	$\cos \angle CAB = \frac{AD+5}{20}$ $\cos 36.870^\circ = \frac{AD+5}{20}$ $AD+5 = 16.000$ $AD = 11.0 \text{ m}$ <p>or</p> $\tan \angle CAB = \frac{12}{AD+5}$ $\tan 36.870^\circ = \frac{12}{AD+5}$ $AD+5 = \frac{12}{\tan 36.870^\circ}$ $AD = 11.0 \text{ m}$ <p>or</p> <p>By Pythagoras' Theorem,</p> $AB^2 = (AD+DC)^2 + BC^2$ $20^2 = (AD+5)^2 + 12^2$ $(AD+5)^2 = 256$ $AD+5 = 16 \text{ or } -16 \text{ (rej)}$ $AD = 11 \text{ m}$	<p>M1</p> <p>A1</p> <p>or</p> <p>M1</p> <p>A1</p> <p>Or</p> <p>M1</p> <p><i>PP if did not reject</i> -16</p> <p>A1</p>
11ai	$\frac{150}{2x}$ or $\frac{75}{x}$	B1
11aii	$\frac{52}{x-2}$	B1
11b	$\frac{52}{x-2} - \frac{150}{2x} = \frac{1}{2}$ $\frac{104x - 150(x-2)}{2x(x-2)} = \frac{1}{2}$ $\frac{104x - 150x + 300}{2x^2 - 4x} = \frac{1}{2}$ $-92x + 600 = 2x^2 - 4x$ $2x^2 + 88x - 600 = 0$ $x^2 + 44x - 300 = 0$	<p>M1</p> <p>M1</p> <p>A1</p>
11c	$x^2 + 44x - 300 = 0$ $(x+50)(x-6) = 0$ $x = -50 \text{ and } x = 6$	<p>M1</p> <p>A1, A1</p>

11d	Reject: -50 Time taken $= \frac{52}{6-2}$ $= 13h$	M1 A1
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2 Express EOY 2022

1a	$\frac{3x-10}{5} \geq \frac{2(x-5)}{3}$ $9x-30 \geq 10(x-5)$ $9x-30 \geq 10x-50$ $9x-10x \geq -50+30$ $-x \geq -20$ $x \leq 20$	M1 M1 A1										
1b	19	B1										
2ai	$\frac{2}{20} = \frac{1}{10}$	B1										
2aii	$\frac{9}{10}$	B1										
2b	$\frac{7+x}{20+x} = \frac{1}{2}$ $14+2x = 20+x$ $2x-x = 20-14$ $x = 6$	M1 A1										
3	A = 30 B = 32 C = 33	B1 B1 B1										
4	$\frac{1}{3}\pi(1.5r)^2(0.5h)$ $= 1.125\left(\frac{1}{3}\right)\pi r^2 h$ $1.125 \times 400 = 450 \text{ cm}^3$	M1 A1										
5a	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Stem</th> <th style="text-align: center;">Leaf</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">4 6</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0 1 5 5 5 6 8 8 9 9</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">2 2 3 4 5 8 9</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">0</td> </tr> </tbody> </table> <p>Key: 0 4 represents 4 marks</p>	Stem	Leaf	0	4 6	1	0 1 5 5 5 6 8 8 9 9	2	2 2 3 4 5 8 9	3	0	B2,1, 0 PP for no key
Stem	Leaf											
0	4 6											
1	0 1 5 5 5 6 8 8 9 9											
2	2 2 3 4 5 8 9											
3	0											

5b	$\frac{18+19}{2}$ $= 18.5$	M1 A1
5c	19	B1
6a	$\frac{a^2 - a}{a}$ $= \frac{a(a-1)}{a}$ $= a - 1$	M1 A1
6b	$\frac{3x^2y^2z^3}{(5yz^2)^2} \div \frac{27x^2y}{20y^2z}$ $= \frac{3x^2y^2z^3}{25y^2z^4} \div \frac{27x^2y}{20y^2z}$ $= \frac{3x^2y^2z^3}{25y^2z^4} \times \frac{20y^2z}{27x^2y}$ $= \frac{4y}{45}$	M1 (expansion) M1 (KCF) A1
6c	$\frac{2}{m+2} - \frac{6(m-1)}{m^2-4}$ $= \frac{2(m-2)}{(m+2)(m-2)} - \frac{6(m-1)}{m^2-4}$ $= \frac{2m-4-6m+6}{m^2-4}$ $= \frac{-4m+2}{m^2-4}$	M1 M1 A1
7a	$4\pi r^2 = 9162$ $r^2 = 728.99$ $r = 27 \text{ or } r = -27(\text{NA})$	M1 A1, A1
7b	<p>Volume of one hemisphere = $\frac{2}{3}\pi(3)^3$</p> <p>Volume of the sphere = $\frac{4}{3}\pi(27)^3$</p> <p>Number of hemispheres = $\frac{4}{3}\pi(27)^3 \div [\frac{2}{3}\pi(3)^3] = 1458$</p>	M1 M1, A1

7c	<p>Surface area of one hemisphere = $3\pi(3)^2 = 27\pi$</p> <p>Total cost = $27(3.142) \times \\$0.40 \times 1458$</p> <p>Total cost = \$49475.19</p> <p>He requires more than \$49 000, thus his claim is incorrect.</p>	M1 M1 A1
8a	105	B1
8b	$\tan 55^\circ = \frac{4}{DC}$ $DC = \frac{4}{\tan 55^\circ}$ $AC = \frac{4}{\tan 20^\circ}$ $AB = 13.8$ $XZ = 13.8$	M1 M1 A1
9	$\frac{AX}{AS} = \frac{WX}{YS}$ $\frac{8}{AS} = \frac{16}{6}$ $AS = 3 \text{ cm}$	M1 M1 A1
10a	$a = 0$ $b = 8$	B1 B1
10b	On graph paper	B2 – all points plotted correctly (B1 for 4 correct points) B1 – smooth quadratic curve
10c	$x = -1.5$ or $x = 2.5$	B1, B1
10d	$x = 0.5$	B1