4

BEATTY SECONDARY SCHOOL
MID-YEAR EXAMINATION 2016

SUBJECT : Mathematics
LEVEL : Sec 2 Express

PAPER : 1
DURATION : 1 hour 15 minutes

SETTER : MS IRENE NG
DATE : 12 May 2016

CLASS :	NAME :	REG NO :

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on the top of this page.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.
If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
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, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

For Examiner's Use
50

This paper consists of 10 printed pages (including this cover page)

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1 Expand and simplify

(a) $5x(x-9y)$,

(b) $3(2x+1)^2-(4x^2+13)$

Answers (a) [1]

(b) [2]

2 It is given that $T=\frac{1}{5}k(p^2-q^2)$.

(a) Find the value of T when $k=28$, $p=14$ and $q=11$.

(b) Express q in terms of T, k and p.

Answers (a) ..... [1]

(b) ..... [2]

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3. Solve the simultaneous equations.

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$$2x + 5y = 4$$
$$3x - 2y = 25$$

Answer $x =$., $y =$ .. [3]

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4 Express as a single fraction in its simplest form

$$\frac{1}{4x-7} - \frac{5}{3x+1}$$

Answer ..... [3]

5 Solve each of the following equations.

(a) $(2x-1)(x+8)=0$,

(b) $y^2-2y=5y+60$

Answers (a) [1]

(b) [3]

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6 (a) Factorise $x^2 - 4$.

(b) **Hence**, find two prime factors of 6557.

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Answers (a) ..... [1]

(b) ..... [2]

7 Simplify each of the following.

(a) $\frac{4ab}{3a^2} \div \frac{24ab^3}{9b^2}$

(b) $\frac{7y+3}{(5y-4)^2} \times \frac{15y-12}{3}$

Answers (a) ..... [2]

(b) ..... [2]

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8 y is directly proportional to the square of x.

(a) Given that $y = 12$ when $x = 0.2$, find the equation for y in terms of x.

(b) It is known that $y = p$ for a particular value of x.
Describe the change in y when the value of x is doubled.

Answers (a) ..... [2]

(b) ..... [2]

9 A developer estimates that he needs 96 workers to build a house in 14 days.

(a) If he has 42 workers, how long would he take to build the house?

(b) If the house was to be completed in 8 days, find the additional number of men needed to build the house.

Answers (a) ..... days [2]

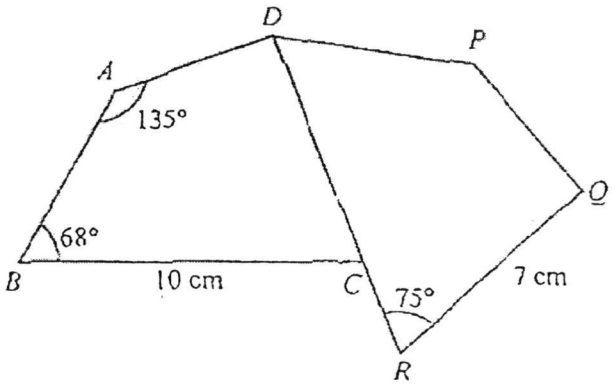
(b) ..... men [2]

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10 In the diagram, quadrilaterals $ABCD$ and $PDRQ$ are congruent.
$BC = 10$ cm, $QR = 7$ cm, $\angle ABC = 68°$, $\angle DAB = 135°$ and $\angle DRQ = 75°$.

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Find

(a) stating your reasons clearly, $\angle PQR$,

(b) obtuse $\angle ADP$,

(c) CR.

Answers (a) ..... [2]

(b) ..... [1]

(c) ..... cm [1]

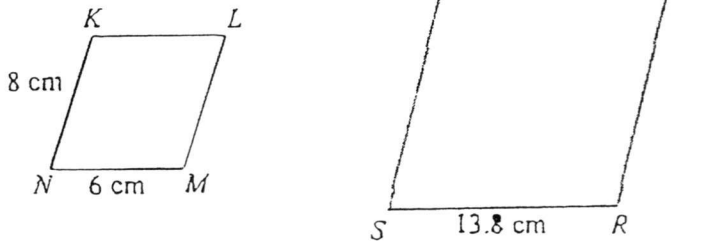
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11 In the diagram, parallelogram $PQRS$ is an enlargement of the parallelogram $KLMN$.
$KN = 8$ cm, $NM = 6$ cm and $SR = 13.8$ cm.



Find

(a) the scale factor of enlargement,

(b) PS,

(c) the area of parallelogram $KLMN$, given that the perpendicular height is 4.8 cm.

Answers (a) ..... [1]

[redacted]

(b) ..... cm [1]

(c) ..... cm^2 [2]

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12 Factorise **completely**

(a) $2ab - ab^2 + 3a^2b$,

(b) $3x^2 + 4x - 39$,

(c) $3pq + 6py - 2xy - xq$.

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Answers (a) [1]

(b) [2]

(c) [2]

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13 A map is drawn to a scale of 1 : 250 000.

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(a) If the distance between two towns on the map is 12 cm, find the actual distance, in metres, between the two towns.

(b) A park has an area of 30 cm^2 on the map. Calculate, in square kilometres, the actual area of the park.

(c) A path is represented by 3.4 cm on the map. Calculate the length of the path, in cm, represented on another map with a scale of 1 cm : 5 km.

Answers (a) [2]

(b) [2]

(c) [2]

-End of Paper-

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Answer key:

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1a) $5x^2 - 45xy$

1b) $8x^2 + 12x - 10$

2a) 420

2b) $q = \pm\sqrt{p^2 - \frac{5T}{k}}$

3 $x = 7, y = -2$

4 $\frac{36 - 17x}{(4x-7)(3x+1)}$

5a $x = \frac{1}{2}$ or $x = -8$

5b $y = 12$ or $y = -5$

6a $(x+2)(x-2)$

6b 79 and 83.

7a $\frac{1}{2a^2}$

7b $\frac{7y+3}{5y-4}$

8a $y = 300x^2$

8b y is 4 times it original value.

9a 32 days

9b 72

10a 82°

10b 150°

10c 3 cm

11a 2.3

11b 18.4 cm

11c 28.8 cm^2

12a $ab(2 - b + 3a)$

12b $(3x+13)(x-3)$

12c $(3p - x)(2y + q)$

13a 30 000 m

13b 187.5 km^2

13c 1.7 cm

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2016 2Exp P1 Marking scheme

1a	$5x(x-9y)$ $=5x^2-45xy$	B1
1b	$3(2x+1)^2-(4x^2+13)$ $=3(4x^2+4x+1)-4x^2-13$ $=12x^2+12x+3-4x^2-13$ $=8x^2+12x-10$	M1 A1
2a	$T=\frac{1}{5}(28)(14^2-11^2)$ $T=420$	B1
2b	$T=\frac{1}{5}k(p^2-q^2)$ $\frac{5T}{k}=p^2-q^2$ $q^2=p^2-\frac{5T}{k}$ $q=\pm\sqrt{p^2-\frac{5T}{k}}$	M1 A1
3	$2x+5y=4 \quad -(1)$ $3x-2y=25 \quad -(2)$ $eq(1)\times 3 \quad 6x+15y=12 \quad -(3)$ $eq(2)\times 2 \quad 6x-4y=50 \quad -(4)$ $eq(3)-(4)$ $15y-(-4y)=12-50$ $19y=-38$ $y=-2$ $sub \quad y=-2 \quad into \quad eq(3)$ $6x+15(-2)=12$ $6x=12+30$ $6x=42$ $x=7$	M1 (elimination or substitution method) A1 A1

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7b	$\frac{7y+3}{(5y-4)^2} \times \frac{15y-12}{3}$ $= \frac{7y+3}{(5y-4)^2} \times \frac{3(5y-4)}{3}$ $= \frac{7y+3}{5y-4}$	M1 A1
8a	$y = kx^2$ $12 = k(0.2)^2$ $12 = 0.04k$ $k = 300$ $y = 300x^2$	M1 A1
8b	$p = 300x^2$ new $y = 300(2x)^2$ $y = 4(300x^2)$ $y = 4p$ y is 4 times its original value.	M1 A1
9a	96 men → 14 days 1 man → 1344 days 42 men → 32 days	M1 A1
9b	1 day → 1344 men 8 days → 168 men Additional number of men = 168 – 96 = 72	M1 A1
10a	$\angle BCD$ $= \angle DRQ$ $= 75°$ $\angle ADC$ $= 360° - 135° - 68° - 75°$ $= 82°$ ($\angle$ sum of quad) $\angle PQR$ $= \angle ADC$ $= 82°$	M1 A1 or B2 (with reason stated)

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4	$\frac{1}{4x-7} - \frac{5}{3x+1}$ $= \frac{3x+1-5(4x-7)}{(4x-7)(3x+1)}$ $= \frac{3x+1-20x+35}{(4x-7)(3x+1)}$ $= \frac{36-17x}{(4x-7)(3x+1)}$	 M1 M1 A1
5a	$(2x-1)(x+8)=0$ $2x-1=0 \quad x+8=0$ $2x=1 \qquad x=-8$ $x=\frac{1}{2}$	 B1 (both answers must be correct)
5b	$y^2-2y=5y+60$ $y^2-2y-5y-60=0$ $y^2-7y-60=0$ $(y-12)(y+5)=0$ $y-12=0 \quad or \quad y+5=0$ $y=12 \qquad y=-5$	 M1 M1 (factorisation) A1
6a	x^2-4 $=(x+2)(x-2)$	 B1
6b	6557 $=81^2-2^2$ $=(81+2)(81-2)$ $=(83)(79)$ Hence, the two prime factors are 83 and 79.	 M1(application must be seen) A1
7a	$\frac{4ab}{3a^2} \div \frac{24ab^3}{9b^2}$ $= \frac{4ab}{3a^2} \times \frac{9b^2}{24ab^3}$ $= \frac{1}{2a^2}$	 M1 A1

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10b	$82° + 68° = 150°$	B1
10c	$DR = BC = 10\text{cm}$ $DC = QR = 7\text{ cm}$ $CR = 10 - 7$ $= 3\text{ cm}$	 B1
11a	$\frac{13.8}{6}$ $= 2.3$	 B1
11b	$\frac{PS}{KN} = \frac{SR}{NM}$ $PS = 2.3 \times 8$ $PS = 18.4\ cm$	 B1
11c	Area of $KLMN$ $= 6 \times 4.8$ $=28.8\text{ cm}^2$	 M1 A1
12a	$2ab - ab^2 + 3a^2b$ $= ab(2 - b + 3a)$	 B1
12b	$3x^2 + 4x - 39$ $= (3x + 13)(x - 3)$	 M1A1 or B2
12c	$3pq + 6py - 2xy - xq$ $= 3p(q + 2y) - x(2y + q)$ $= (3p - x)(2y + q)$	 M1 A1
13a	1cm : 2500 m 12 cm : 12 × 2500 =30 000 m	M1 A1
13b	1 cm : 2.5 km 1 cm^2 : 6.25 km^2 30 cm^2 : 30 × 6.25 = 187.5 km^2	 M1(map scale) A1
13c	1 cm : 2.5 km 3.4 cm : 3.4 × 2.5 = 8.5 km (actual length) 5 km : 1 cm 8.5 km : $\frac{8.5}{5} \times 1$ = 1.7 cm	 M1 A1

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BEATTY SECONDARY SCHOOL
MID-YEAR EXAMINATION 2016

SUBJECT : Mathematics
LEVEL : Sec 2 Express

PAPER : 2
DURATION : 1 hour 30 minutes

SETTER : Mr Cheong Boon Wee
DATE 13 May 2016

CLASS :	NAME :	REG NO :

READ THESE INSTRUCTIONS FIRST

Write your name. class and index number in the spaces on the top of this page.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.
Calculators should be used 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, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

This paper consists of 5 printed pages (including this cover page)

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1 The actual area of Sungei Buloh Wetland Reserve is 1.3 km^2.
A scale of 1 cm represents 1.5 km on the map.

(a) Express the scale in the form of $1 : n$. [1]

(b) Calculate the area of Sungei Buloh Wetland Reserve on the map in cm^2. [2]

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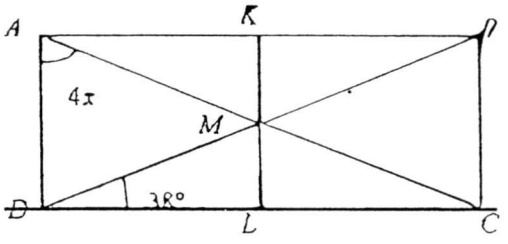
2 The dimensions of a rectangle is $(x - y)$cm by $(x^2 - 2xy + 1)$ cm

(a) Find an expression, in terms of x and y, for the area of the rectangle.
You are expected to expand and simplify the area of this rectangle. [2]

(b) Given $x = 6$ and $y = 1$, calculate the area of this rectangle. [1]

---

3 $ABCD$ is a rectangle. The diagonals AC and BD intersect at the point M.
KL is a line that divides the rectangle into equal halves, and M is on KL.



(a) Write down two triangles that are congruent to each other. [1]

(b) Given that $\angle BDC = 38°$ and $\angle CAD = 4x$, find the value of x. [2]

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4 (a) m is inversely proportional to the cube of p.

It is known that $m = 9$ for a particular value of p.

Find the value of m when this value of p is tripled. [2]

(b) The table shows some corresponding values of x and b.

x	2	4	6
b	12	24	36

(i) Show that x and b are in direct proportion. [2]

(ii) Sketch the graph of b against x. [1]

---

5 (a) If $a^2 + b^2 = 12$ and $a + b = 4$, find the value of $10ab$ [3]

(b) (i) Expand $(2x - 3)(2x + 3)$. [1]

(ii) Hence, find the value of 397×403 without the use of a calculator.
Show your workings clearly. [2]

---

6 Ali has x number of \$2 notes, while Ken has y number of \$5 notes.

(a) (i) If there are 8 notes in total, write down an equation involving x and y. [1]

(ii) If the total value of the notes is \$25, write down an equation involving x and y. [1]

(b) Solve the two equations in (a) to find the value of x and of y. [3]

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7 (a) Factorise completely

(i) $2x^2 - 16x + 32$. [2]

(ii) $3x^2 - 48$ [2]

(b) Hence, express the following as a fraction in its simplest form

$$\frac{4}{x+4} + \frac{3}{3x^2-48}.$$ [3]

---

8 (a) Simplify $\frac{2x+6y}{6x^2} \times \frac{9x^3}{x^2+6xy+9y^2}$ [3]

(b) Solve the equation $\frac{4x+2}{11} = \frac{2}{x-4}$ [3]

(c) Given that $y = \frac{4a-7}{b-a}$, express a in terms of b and y. [3]

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9 A strawberry box contains y strawberries. A lychee box contains 8 less lychees compared to the number of strawberries in a strawberry box.

There are $\frac{y}{2}$ strawberries boxes and thrice as many lychee boxes.

(a) Write down in terms of y,

(i) the number of lychees in one lychee box, [1]

(ii) the total number of lychees in all the lychee boxes.

(b) Show that the total number of strawberries and lychees is $2y^2 - 12y$. [2]

The total number of strawberries and lychees is 144.

(c) Find the number of strawberries in one box. [3]

(d) The profit from selling one strawberry box is $\$(0.9x + 2)$

If the total profit of selling all the strawberry boxes is \$120,

find the value of x. [2]

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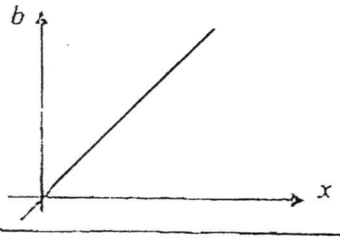
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Mid-Year Exam 2016
Mathematics / Paper 2
Sec 2 Express
Setter: Cheong Boon Wee

Mark Scheme
Deduct 1 mark overall for no units given for Q1b, 2a, 2b

Question No.	Workings	Marks	Remarks
1(a)	1 : 150 000	B1	
1(b)	Area on map $= \dfrac{1.3}{1.5^2}$ $= 0.578\ \text{cm}^2$ (3 s.f.)	M1 A1	
2(a)	Area of rectangle $= (x-y)(x^2-2xy+1)$ $= x^3-2x^2y+x-x^2y+2xy^2-y$ $= (x^3-3x^2y+x+2xy^2-y)\ \text{cm}^2$	M1 A1	
2(b)	Area of rectangle $= 6^3-3(6)^2(1)+6+2(6)(1)^2-(1)$ $= 125\ \text{cm}^2$	B1	
3(a)	$\Delta AKM \equiv \Delta BKM$; $\Delta BAC \equiv \Delta DCA$ $\Delta DML \equiv \Delta CML$; $\Delta ABD \equiv \Delta BDC$	B1	Accept any one of the combination.
3(b)	$\angle CAD = 4x$ $90° - 38° = 4x$ $52° = 4x$ $x = 13°$	M1 A1	
4(a)	Let $m = \dfrac{k}{p^3}$ $9 = \dfrac{k}{p^3}$ $k = 9p^3$	M1	

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	$m = \frac{9p^3}{(3p)^3}$ $m = \frac{9p^3}{27p^3}$ $m = \frac{9}{27} = \frac{1}{3}$	A1	
4(b)(i)	$\frac{12}{2} = 6$ $\frac{24}{4} = 6$ $\frac{36}{6} = 6$ Since $\frac{b}{x} = 6$ = constant Hence x and b are in direct proportion	B2	Show that the $\frac{b}{x} = 6$ for all values of corresponding b and x Define the constant =6
4(b)(ii)		B1	Accept if student: -Give the correct axes -Straight line which cuts the point of origin
5(a)*	$(a+b)^2 = 4^2$ $a^2 + 2ab + b^2 = 16$ $a^2 + b^2 + 2ab = 16$ $12 + 2ab = 16$ $2ab = 4$ $ab = 2$ $10ab = 10(2) = 20$	M1 M1 A1	Accept if student attempt to use $(a+b)^2$
5(b)(i)	$(2x-3)(2x+3)$ $= 4x^2 - 9$	B1	

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5(b)(ii)	$397\times403=(400-3)(400+3)$ $=(2\times200-3)(2\times200+3)$ $=4(200)^2-9$ $=160000-9$ $=159991$	M1 A1	
6(a)(i)	$x+y=8$	B1	
6(a)(ii)	$2x+5y=25$	B1	
6(b)	$x+y=8$ ---------- (1) $2x+5y=25$ ---------- (2) From (1): $x=8-y$ ---------- (3) Sub (3) into (2): $2(8-y)+5y=25$ $16-2y+5y=25$ $16+3y=25$ $3y=9$ $y=3$ Sub $y=3$ into (3): $x=8-3$ $=5$	 M1 A1 A1	
7(a)(i)	$2x^2-16x+32=2(x^2-8x+16)$ $=2(x-4)^2$	M1 A1	
7(a)(ii)	$3x^2-48=3(x^2-16)$ $=3(x+4)(x-4)$	M1 A1	

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7(b)	$\frac{4}{x+4}+\frac{3}{3x^2-48}$ $=\frac{4}{x+4}+\frac{3}{3(x+4)(x-4)}$ $=\frac{4(3)(x-4)+3}{3(x+4)(x-4)}$ $=\frac{12x-45}{3(x+4)(x-4)}$ $=\frac{3(4x-15)}{3(x+4)(x-4)}$ $=\frac{4x-15}{(x+4)(x-4)}$	M1- Factorisation of expressions M1 A1	
8(a)	$\frac{2x+6y}{6x^2}\times\frac{9x^3}{x^2+6xy+9y^2}$ $=\frac{2(x+3y)}{6x^2}\times\frac{9x^3}{(x+3y)^2}$ $=\frac{2(3x)}{2(x+3y)}$ $=\frac{3x}{x+3y}$	M2- Factorisation of expression and simplification of factors A1	
8(b)	$\frac{4x+2}{11}=\frac{2}{x-4}$ $(x-4)(4x+2)=22$ $4x^2+2x-16x-8=22$ $4x^2-14x-30=0$ $2x^2-7x-15=0$ $(2x+3)(x-5)=0$ $x=-\frac{3}{2}$ or $x=5$	M1- Expansion M1 Correct Factorisation A1	
8(c)	$y=\frac{4a-7}{b-a}$ $by-ay=4a-7$ $by+7=4a+ay$ $by+7=a(4+y)$ $a=\frac{by+7}{4+y}$	M1- Cross Multiplication M1 Factorisation and isolation A1	

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9(a)(i)	$(y-8)$	B1	
9(a)(ii)	$\frac{3y}{2}(y-8)$	B1	
9(b)	$\frac{y}{2}(y)+\frac{3y}{2}(y-8)$ $=\frac{y^2}{2}+\frac{3y^2-24y}{2}$ $=\frac{4y^2-24y}{2}$ $=2y^2-12y$	M1 A1	
9(c)	$2y^2-12y=144$ $2y^2-12y-144=0$ $y^2-6y-72=0$ $(y-12)(y+6)=0$ $y=12$ or $y=-6$ There are 12 strawberries in one box.	M1-Correct equation M1-Factorisation A1	No A1 awarded if student leave two values for y.
9(d)	$(0.9x+2)\times\frac{12}{2}=120$ $(0.9x+2)\times 6=120$ $5.4x+12=120$ $5.4x=108$ $x=20$	M1 A1	

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