



2010 Annual Examination

FORM II MATHEMATICS

Wednesday 3rd November 2010

QUESTION ONE (13 marks) Start a new page.

(a) Write $\frac{38}{5}$ as a mixed numeral.

(b) Calculate:

(i) 40% of 20

(ii) 1.2^2

(iii) $180 \div (6 \times 3)$

(c) Divide 24 by $\frac{1}{4}$.

(d) Factorise $4x + 12$.

(e) Simplify $\frac{8x}{3} \times \frac{x}{16}$.

(f) Solve $2x + 3 = 15$.

(g) Simplify the following, writing your answers in index form:

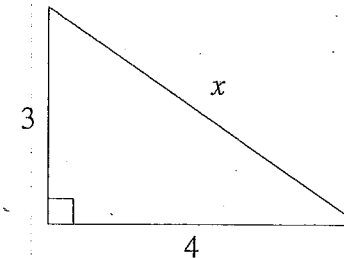
(i) $m^7 \times m^3$

(ii) $y^{200} \div y^{50}$

(h) Write an algebraic expression for the number that is 6 less than t .

(i) Graph $x \leq -2$ on a number line.

(j)



Find the value of x in the diagram above.

General Instructions

- Writing time — 2 hours
- Write using black or blue pen.
- Calculators are not to be used.
- All necessary working should be shown in every question.
- Start each question on a new page.

Structure of the paper

- Total marks — 130
- All ten questions may be attempted.
- All ten questions are of equal value.

Collection

- Write your name, class and master clearly on each page of your answers and on the tear-off sheet.
- Staple your answers in a single bundle.
- Bundle the tear-off sheet with the question it belongs to.
- Write your name and master on this question paper and submit it with your answers.

2A: KWM
2D: LYL
2G: RCF

2B: SJE
2E: TCW
2H: SO

2C: JMR
2F: BR
2I: MW

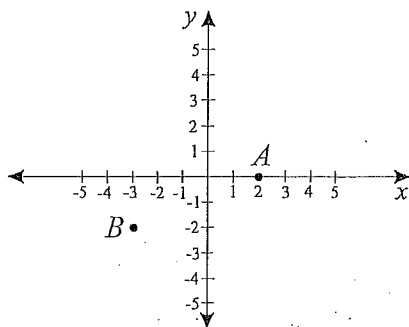
Checklist

- Writing paper required.
- Candidature — 188 boys

Examiner
BR

QUESTION TWO (13 marks) Start a new page.

(a)



The diagram above shows the points *A* and *B* in the number plane. Write down the coordinates of each point.

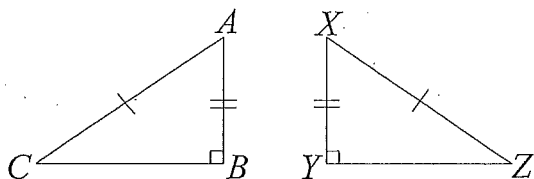
(b) Write $\frac{48}{60}$ as a percentage.

(c) A map is drawn to a scale of 1 : 100 000. How many kilometres are represented by a distance of 13.5 cm on the map?

(d) Simplify the ratio $2 : 1\frac{1}{3}$.

(e) Solve $3 - x = 21$.

(f)



What congruence test could you use to show that $\triangle ABC \cong \triangle XYZ$?

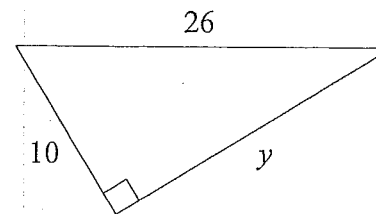
(g) Expand and simplify $(4x + 5)(4x - 5)$.

(h) Find an equation linking x and y in the table below.

x	0	1	2	3
y	7	12	17	22

QUESTION THREE (13 marks) Start a new page.

(a)



Find the value of y in the diagram above.

(b) Name all the special quadrilaterals from the following list that must have diagonals intersecting at right-angles:

- Kite Parallelogram Rectangle Rhombus Square Trapezium

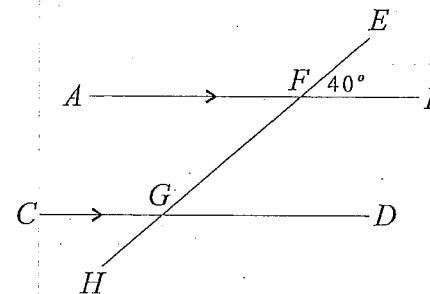
(c) Solve $1 - 2x \leq 13$.

(d) If $M = x^2 - yz$, find the value of M when $x = -3$, $y = -2$ and $z = 3$.

(e) Divide \$400 in the ratio of 2 : 3.

(f) If half a litre of paint covers 3 m^2 , how much paint is needed to cover 17 m^2 ?

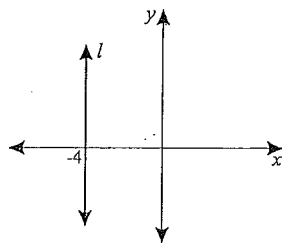
(g)



Find the size of $\angle DGH$, giving reasons.

QUESTION FOUR (13 marks) Start a new page.

(a)



The number plane above shows the vertical line l .

(i) What is the equation of the line l ?

(ii) What is the equation of the x -axis?

(b) If 5 apples cost \$2.25, what is the cost of 12 apples?

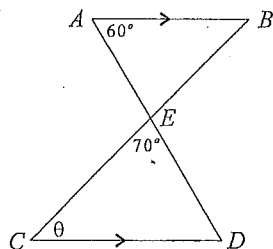
(c) Fully factorise $6a^2 + 27a$.

(d) Simplify $(5x^2y^8)^3$.

(e) Solve $\frac{2x}{3} + \frac{x}{4} = 1$.

(f) A group of kindergarten children are asked to choose their favourite ice cream flavour. Of the group, $\frac{1}{4}$ of them chose chocolate, $\frac{2}{5}$ chose cookies and cream, $\frac{3}{10}$ chose vanilla and the rest chose strawberry. What percentage of the children chose strawberry flavoured ice cream?

(g)



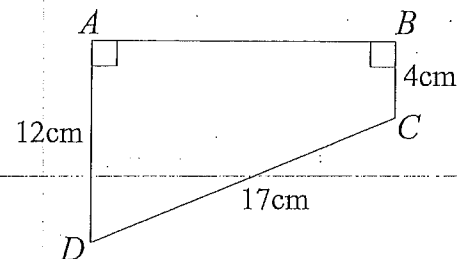
In the diagram above, $AB \parallel CD$. Find the value of θ , giving reasons.

QUESTION FIVE (13 marks) Start a new page.

(a) Simplify $3x - 2(4x - 5)$.

(b) The ratio of A to B is $2 : 3$. The ratio of B to C is $5 : 8$. What is the simplified ratio of A to C ?

(c)



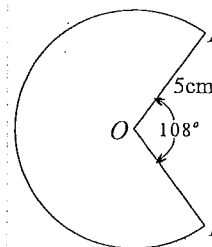
Find the perimeter of the trapezium $ABCD$ shown above.

(d) The area of a circle is $64\pi \text{ cm}^2$. Find the exact circumference of the circle.

(e) (i) Graph the line $y = 2 - 3x$ on a number plane.

(ii) Hence, or otherwise, find the point of intersection of the line $y = 2 - 3x$ and the line $y = -1$.

(f)



The diagram above shows the major sector AOB with radius $OA = OB = 5 \text{ cm}$ and $\angle AOB = 108^\circ$. Find its area using the approximation $\pi \doteq \frac{22}{7}$.

QUESTION SIX (13 marks) Start a new page.

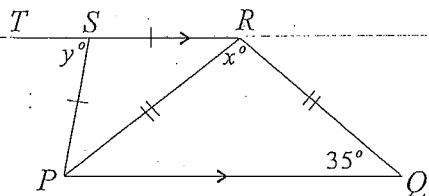
(a) Solve:

(i) $2(3 - x) + 4x = 7x + 21$

(ii) $\frac{5}{3x} = 7 - \frac{4}{x}$

(b) A bullet is fired at a speed of 800 metres per second. What is its speed in kilometres per hour?

(c)

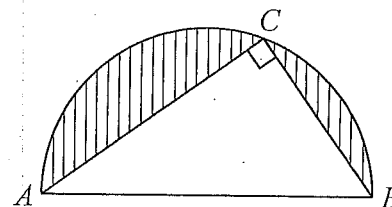


The diagram above shows a quadrilateral $PQRS$ in which $PQ \parallel SR$, $PS = SR$ and $PR = RQ$. Also, RS is produced to T . Let $\angle PRQ = x^\circ$ and $\angle TSP = y^\circ$.

- (i) Given that $\angle RQP = 35^\circ$, find the value of x , giving reasons.
 - (ii) Find the value of y , giving reasons.
- (d) Perform the constructions outlined on the tear-off sheet at the end of this examination paper. This sheet should be bundled with the rest of your answers to Question Six.

QUESTION SEVEN (13 marks) Start a new page.

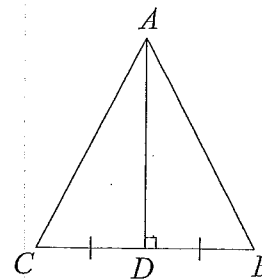
(a)



In the diagram above, AB is the diameter of a semi-circle. $AC = 6$ cm, $CB = 4$ cm and $\angle ACB = 90^\circ$. Find the exact area of the shaded region.

- (b) Write a simplified expression for $a\%$ of $\$b$ in cents.
- (c) Andrew has a total of $\$6$ made up of 10-cent coins and 20-cent coins. He has twice as many 10-cent coins as 20-cent coins.
 - (i) Let the number of 10-cent coins be n . Form an equation for Andrew's total amount of money.
 - (ii) Solve the equation to find how many coins Andrew has of each type.
- (d) Simplify $8m^0 + 8^0m^0 + 8^0m + (8m)^0$.
- (e) If a car travels at A km/h, how many kilometres will it travel in x minutes?
- (f) Aaron's investment was valued at $\$25\,500$. Due to the Global Financial Crisis, his investment decreased by a total of 12% over a six month period. Find the new-value of Aaron's investment.

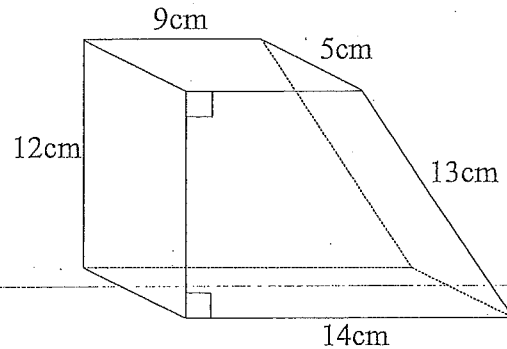
(g)



Use congruence to prove $\triangle ABC$ is isosceles. Give all reasons.

QUESTION EIGHT (13 marks) Start a new page.

(a)



- (i) Find the volume of the prism shown above.
- (ii) Find the surface area of the prism shown above.

(b) Simplify $\frac{9a^{17}b^5}{28ab^3} \div \frac{3a^3b^2}{7a^5b^8}$.

(c) Alex owns a music shop. He is having a sale giving 15% off the price of all instruments. Kevin is a regular customer and has a loyalty rewards card entitling him to a further 5% off the sale price. He decides to buy a double bass originally worth \$25 000.

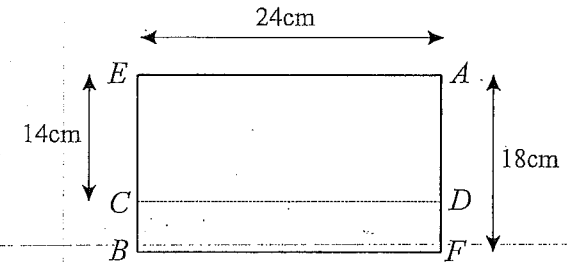
- (i) How much does Kevin pay for the double bass?
- (ii) What single percentage discount is equivalent to these successive discounts?

(d) A rectangular tank with a square base of side length 5 metres contains water to a depth of 4 metres. A solid cylinder of height 3 metres and diameter 80 cm is placed on the bottom of the tank. Find how much the water level rises. Give your answer in terms of π .

QUESTION NINE (13 marks) Start a new page.

(a) Solve $\frac{5x+2}{x-1} = \frac{5x-7}{x+3}$.

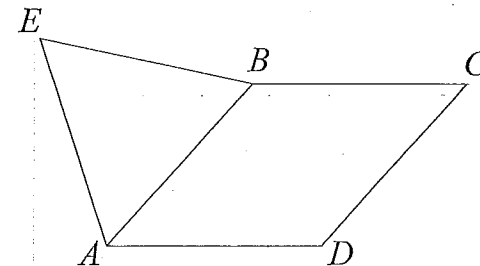
(b)



A rectangular sheet of paper $EAFB$ measures 24 cm by 18 cm, as shown above. It is folded flat along the line CD , so that $EC = AD = 14$ cm. How many centimetres is B now closer to A than it was before?

(c) A furnace is three-quarters of its normal operating temperature when the power is switched off. Two hours later the temperature of the furnace has dropped by 400°C , and is now two-thirds of its normal operating temperature. Form an equation and solve it to find the normal operating temperature.

(d)

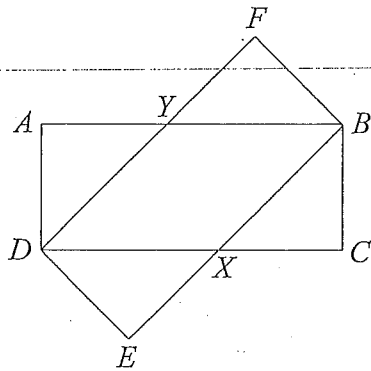


In the diagram above, $ABCD$ is a rhombus with $\angle BCD = 48^\circ$. ABE is an equilateral triangle.

- (i) Draw a neat sketch showing this information.
- (ii) Find the size of $\angle EAD$, giving reasons.
- (iii) Join ED and find the size of $\angle EDA$, giving reasons.

QUESTION TEN (13 marks) Start a new page.

- (a) Solve $\frac{x+5}{6} - \frac{x+1}{9} = \frac{x+3}{4}$.
- (b) A rectangular pool is 50% longer than it is wide. It is surrounded by a path one metre wide. The area of the path is 44 square metres. The pool is full of water. Find the area of the water surface in square metres.
- (c)



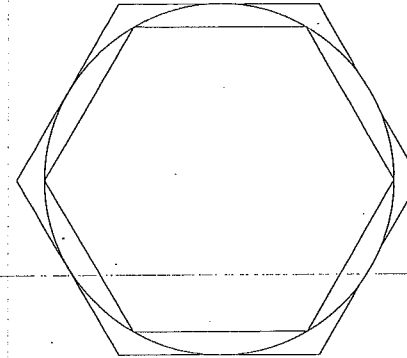
$ABCD$ and $DFBE$ are two congruent rectangles with sides 3 and 7 units, as in the diagram above ($AB = DF = 7, AD = DE = 3$).

- (i) Using congruence, show that $AY = \frac{20}{7}$.
- (ii) Find the area of the figure $DXBY$.

Question 10 continues over the page.

QUESTION TEN (Continued)

(d)



The diagram above shows a circle of radius 6 cm. A regular hexagon has been inscribed in the circle and a second larger regular hexagon has been circumscribed about the circle.

- (i) Find the exact area of the inscribed hexagon.
- (ii) Find the exact ratio of the area of the circumscribed hexagon to that of the inscribed hexagon.

END OF EXAMINATION

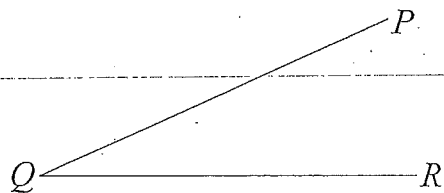
NAME: CLASS: MASTER:

DETACH THIS SHEET AND BUNDLE IT WITH THE REST OF QUESTION SIX.

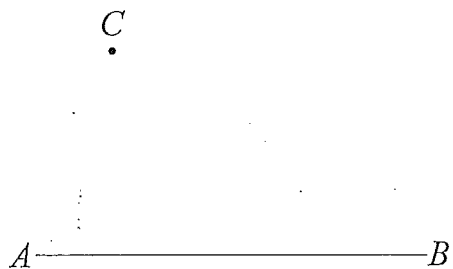
QUESTION SIX

(d) In the following questions leave all construction arcs visible.

(i) Copy $\angle PQR$ at X to form $\angle ZXY$.



(ii) Construct an interval CD that is parallel to AB .



Form II Ann. 2010 Solns

Question 1

a) $7\frac{3}{5}$ ✓

b) i) 8 ✓

ii) 1.44 ✓

iii) 10 ✓

c) 96 ✓

d) $4(x+3)$ ✓

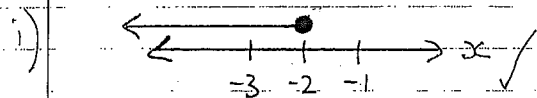
e) $\frac{x^2}{6}$ ✓

f) $x = 6$ ✓

g) i) m^{10} ✓

ii) y^{150} ✓

h) ± -6 ✓



j) $x = 5$ units ✓

13

Question 2

a) A(2, 0) ✓ B(-3, -2) ✓

b) $\frac{1648}{1360} \times 100\% = 80\%$ ✓

c) 1cm : 100 000 cm ✓
= 13.5cm : 1 350 000 cm ✓
= 13.5cm : 13 500 m ✓
= 13.5cm : 13.5 km ✓
∴ 13.5km is represented by 13.5cm on the map. ✓

d) $2 : 1\frac{1}{3} = 2 : \frac{4}{3}$
= 6 : 4 ✓
= 3 : 2 ✓

e) $3 - x = 21$
 $-x = 18$
∴ $x = -18$ ✓

f) RHS ✓

g) $(4x+5)(4x-5) = 16x^2 - 20x + 20x - 25$ ✓
 $= 16x^2 - 25$ ✓

h)

x	0	1	2	3
y	7	12	17	22

 $y = 5x + 7$ ✓

13

Question 3

a) $y^2 = 26^2 - 10^2$ ✓
 $= 676 - 100$
 $= 576$
 $y = \sqrt{576}$ ✓
 $= 24$ units

$$\begin{array}{r} 126 \times \\ \underline{28} \\ 156 \\ \underline{520} \\ 676 \end{array}$$

b) Kite, Rhombus, Square ✓

c) $1 - 2x \leq 13$
 $-2x \leq 12$ ✓
 $x \geq -6$ ✓

[x ✓ for $x \leq -6$ or $x \geq 6$]

d) $M = x^2 - yz$
 $= (-3)^2 - (-2)(3)$ ✓
 $= 9 + 6$
 $= 15$ ✓

e) Sparts. 1 part = $\frac{\$400}{5}$
 $= \$80$ ✓
2 parts = $\$160$
3 parts = $\$240$ ✓

So, $\$160 : \240

f) $\frac{1}{2}$ L for 3 m^2
 $\frac{1}{6}$ L for 1 m^2 ✓
 $\frac{17}{6}$ L for 17 m^2

∴ You would need $\frac{17}{6}$ L of paint ✓

$$\left[\text{or} = 2\frac{5}{6} \text{ L} \right]$$

g) $\angle FGD = 40^\circ$ [corresponding \angle 's, $AB \parallel CD$] ✓
 $\therefore \angle DGH = 140^\circ$ [straight \angle FGH] ✓

13

Question 4

a) i) $x = -4$ ✓

ii) $y = 0$ ✓

b)

5 apples	costs	\$2.25	✓	45
1 apple	costs	\$0.45	✓	12
12 apples	costs	\$5.40	✓	90
				114.50
				5.40

c) $6a^2 + 27a = 3a(2a + 9)$ ✓

d) $(5x^2y^8)^3 = 125x^6y^{24}$ ✓ ✓ [One for coefficient]
[One for pronumerals]

e) $\frac{2x}{3} + \frac{x}{4} = 1$

$$20x + 3x = 3$$

$$8x + 3x = 12$$
 ✓

$$11x = 12$$

$$x = \frac{12}{11} \text{ or } \left[1 \frac{1}{11}\right] \checkmark$$

f) Fraction of strawberry = $1 - \frac{1}{4} - \frac{2}{5} - \frac{3}{10}$

$$= \frac{20}{20} - \frac{5}{20} - \frac{8}{20} - \frac{6}{20}$$
$$= \frac{1}{20} \checkmark$$

Percentage chose strawberry = $\frac{1}{20} \times 100\%$

$$= 5\% \checkmark$$

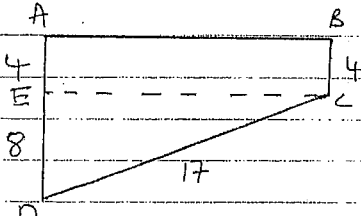
g) $\angle ADC = 60^\circ$ [alternate \angle s, $AB \parallel CD$] ✓
 $\therefore \theta = 180^\circ - 60^\circ - 70^\circ$ [\angle sum of $\triangle EDC$] ✓
 $\therefore \theta = 50^\circ$ ✓

13

Question 5

a) $3x - 2(4x - 5) = 3x - 8x + 10$ ✓
 $= 10 - 5x$ ✓

b) $A:B$ $B:C$
 $2:3$ $5:8$
 $= 10:15$ $15:24$ ✓
 $\therefore A$ to C is $10:24 = 5:12$ ✓

c) 

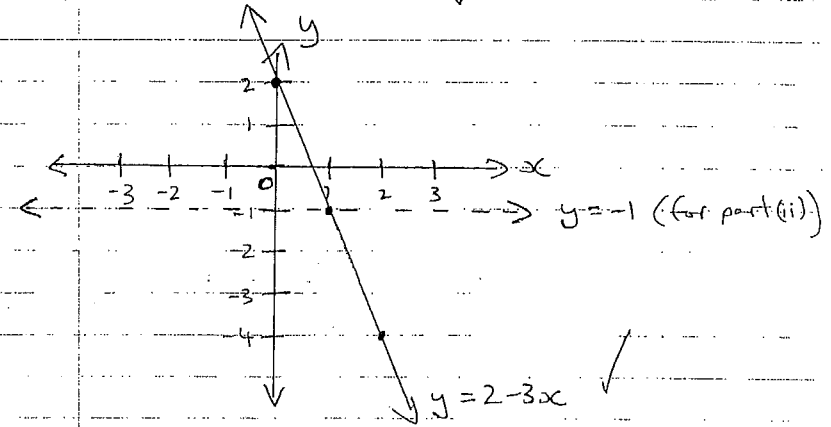
$AB = EC$	17
$AB^2 = 17^2 - 8^2$	17^2
$= 289 - 64$	119
$AB^2 = 225$ ✓	170
$AB = 15$ ✓	289

\therefore Perimeter $ABCD = 15 + 4 + 17 + 12$
 $= 48 \text{ cm}$ ✓

d) $A = \pi r^2$ $C = 2\pi r$
 $64\pi = \pi r^2$
 $r^2 = 64$ ✓
 $r = 8$ ✓
 $C = 2\pi r$
 $= 2\pi(8)$
 $= 16\pi \text{ cm}$ ✓

e) i) $y = 2 - 3x$

x	0	1	2
y	2	-1	-4



ii) $(1, -1)$ ✓

f) Area = $\frac{(360 - 108)}{360} \cdot \left(\frac{22}{7}\right) \cdot (5)^2$ ✓
 $= \frac{252}{360} \cdot \frac{22 \cdot 11}{7} \cdot 25$
 $= \frac{1210360}{18} \cdot \frac{1}{18}$ ✓
 $= 55 \text{ cm}^2$ ✓

(13)

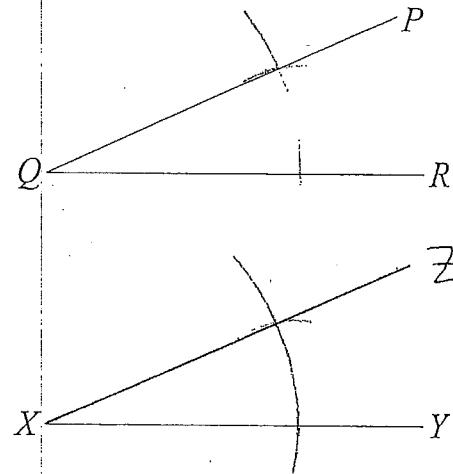
NAME: CLASS: MASTER:

DETACH THIS SHEET AND BUNDLE IT WITH THE REST OF QUESTION SIX.

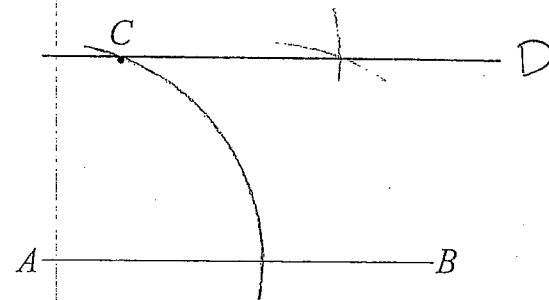
QUESTION SIX

(d) In the following questions leave all construction arcs visible.

(i) Copy $\angle PQR$ at X to form $\angle ZXY$.



(ii) Construct an interval CD that is parallel to AB .



13

Question 6

a) i) $2(3-x) + 4x = 7x + 21$
 $6 - 2x + 4x = 7x + 21$ ✓
 $6 + 2x = 7x + 21$ ✓
 $5x = -15$ ✓
 $x = -3$ ✓

ii) $\frac{5}{3x} = 7 - \frac{4}{2x}$
 $5 = 21x - 12$ ✓
 $21x = 17$
 $x = \frac{17}{21}$ ✓

b) $800 \text{ m per } 1 \text{ s}$
 $= 48000 \text{ m per } 60 \text{ s}$ ✓
 $= 48 \text{ km per } 1 \text{ minute}$ ✓
 $= 2880 \text{ km per } 60 \text{ minutes}$ ✓
 $= 2880 \text{ km/h}$ ✓

c) i) $\angle RPQ = 35^\circ$ [base \angle 's of isos $\triangle RQP$] ✓
 $\therefore x^\circ = 180^\circ - 35^\circ - 35^\circ$ [\angle sum of $\triangle RQP$] ✓
 $x^\circ = 110$ ✓

ii) $\angle PRS = 35^\circ$ [alternate \angle , $SR \parallel PQ$] ✓
 $\angle SPR = 35^\circ$ [base \angle 's of isos $\triangle SRP$] ✓
 $\therefore y^\circ = 35^\circ + 35^\circ$ [external \angle of $\triangle SRP$] ✓
 $y^\circ = 70^\circ$ ✓

Question 7

a) $AB^2 = 6^2 + 4^2$
 $AB^2 = 36 + 16$
 $AB = \sqrt{52}$ ✓

$$\begin{aligned} \text{Area} &= \frac{1}{2} \cdot \pi \left(\frac{\sqrt{52}}{2}\right)^2 - \frac{1}{2} (6)(4) \\ &= \frac{1}{2} \cdot \pi \cdot \frac{52}{4} - 12 \\ &= \frac{13\pi}{2} - 12 \text{ cm}^2 \checkmark \end{aligned}$$

b) $\frac{a}{100} \times \frac{b \times 100}{1} = ab$ ✓

c) i) $10n + 20\left(\frac{n}{2}\right) = 600$ ✓

ii) $10n + 10n = 600$
 $20n = 600$
 $n = 30$ ✓
∴ Andrew has 30 10¢ coins ✓
and 15 20¢ coins ✓

d) $8m^0 + 8^0m + 8^0m + (8m)^0$
 $= 8(1) + (1)(1) + (1)m + (1)$
 $= 10 + m$ ✓

e) $s = \frac{d}{t}$
 $d = s \cdot t$
 $= A \cdot \frac{x}{60}$
 $= \frac{Ax}{60} \text{ km}$ ✓ [without units is ok]

f) New value = $25500 (0.88)$ ✓ $\frac{4}{4} \cdot 25500 \times 88$
 $= \$22440$ ✓
 $\frac{204000}{2244000}$

g) $\angle ADC = 90^\circ$ [straight $\angle COB$]
In Δ 's ACD, ABO
 $CO = BO$ [given]
 $\angle ADC = \angle ADB = 90^\circ$ [as above] ✓
 AO is common
∴ $\triangle ACD \cong \triangle ABO$ [SAS]
∴ $AC = AB$ [matching sides of congruent Δ 's] ✓
∴ $\triangle ABC$ is isosceles [two equal sides] ✓

[last part can be proved by base \angle 's]

[Must have a conclusion]

13

Question 8

a) i) $V = \frac{1}{12} (9+14)(12)(5) \checkmark$

$$= (23)(6)(5)$$

$$= (23)(30)$$

$$= 690 \text{ cm}^3 \checkmark$$

23	x
12	
46	
230	
276	

ii) $SA = 14(5) + 9(5) + 12\left(\frac{1}{2}\right)(9+14)(12) \checkmark$

$$+ 5(13) + 12(5)$$

$$= 70 + 45 + (23)(12) + 65 + 60$$

$$= 240 + 276$$

$$= 516 \text{ cm}^2 \checkmark$$

b) $\frac{9a^{17}b^5}{28a^3b^3} \times \frac{7a^5b^8}{3a^3b^2} = \frac{39a^{16}b^2}{428} \times \frac{7a^2b^6}{13} \checkmark$

$$= \frac{3a^{18}b^8}{4} \checkmark$$

c) i) Kevin pays = $25000(0.85)(0.95)$

$$= 21250(0.95) \checkmark$$

$$= \$20187.50 \checkmark$$

225000	x
0.85	
125000	
2000000	
2125000	

1250	x
0.95	
106250	
11912500	
2018750	

ii) Single discount = $1 - (0.85)(0.95) \checkmark$

$$= 1 - 0.8075 \checkmark$$

$$= 0.1925 \checkmark$$

$$= 19.25\% \checkmark$$

495	x
85	
475	
7600	
8075	

d) Volume in tank = $(5)(5)(4) + \pi(0.4)^2(3) \checkmark$

$$= 100 + \pi(0.16)(3)$$

$$= 100 + 0.48\pi$$

$$= 100 + \frac{12\pi}{25} \text{ m}^3 \checkmark$$

Let h be the rise in height

$$100 + \frac{12\pi}{25} = (5)(5)(4+h) \checkmark$$

$$100 + \frac{12\pi}{25} = 100 + 25h$$

$$\frac{12\pi}{25} = 25h$$

$$h = \frac{12\pi}{625}$$

125	x
125	
125	
500	
625	

\therefore The water rises $\frac{12\pi}{625} \text{ m} \checkmark$

13

Question 9

a)

$$\frac{5x+2}{x-1} = \frac{5x-7}{x+3}$$

$$5x+2 = \frac{(5x-7)(x-1)}{x+3}$$

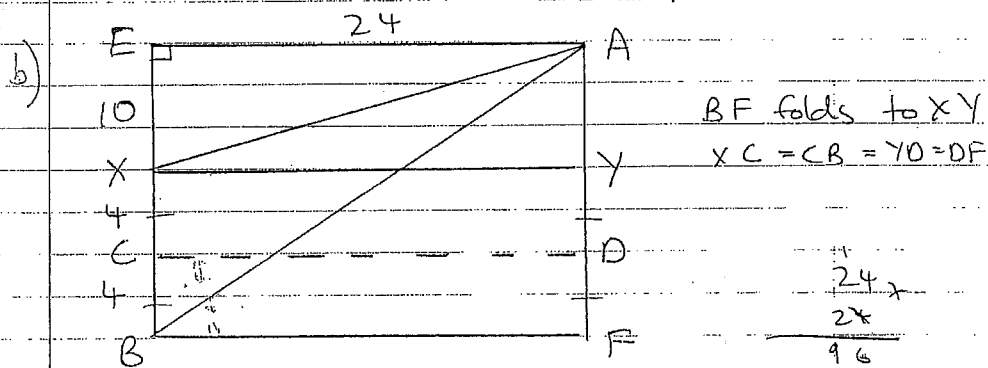
$$(5x+2)(x+3) = (5x-7)(x-1) \quad \checkmark$$

$$5x^2 + 15x + 2x + 6 = 5x^2 - 5x - 7x + 7$$

$$17x + 6 = -12x + 7 \quad \checkmark$$

$$29x = 1$$

$$x = \frac{1}{29} \quad \checkmark$$



$$AX^2 = 24^2 + 10^2$$

$$AX^2 = 576 + 100$$

$$AX^2 = 676$$

$$AX = 26 \quad \checkmark \quad [\text{from Q3(a)}]$$

$$AB^2 = 24^2 + 18^2$$

$$AB^2 = 576 + 324$$

$$AB^2 = 900$$

$$AB = 30 \quad \checkmark$$

$$AB - AX = 4 \text{ cm}$$

\therefore B is now 4 cm closer to A. \checkmark

24	x
2x	x
96	x
1480	x
576	x
18	x
18	x
144	x
1180	x
324	x

c) let T be the normal operating temp.

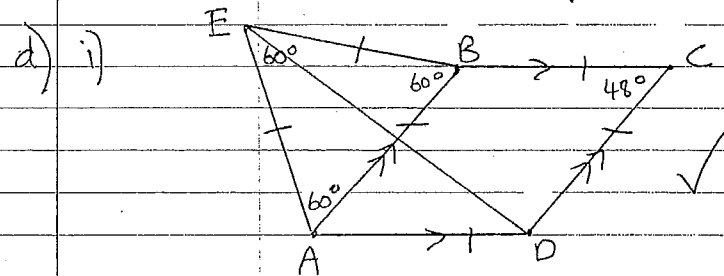
$$\frac{3T}{4} - 400 = \frac{2T}{3} \quad \checkmark$$

$$3T - 1600 = \frac{8T}{3}$$

$$9T - 4800 = 8T$$

$$T = 4800^\circ\text{C}$$

\therefore The normal operating temperature is 4800°C . \checkmark



ii) $\angle BAD = 48^\circ$ [opposite \angle 's of a rhombus]

$\angle EAB = 60^\circ$ [\angle of equil $\triangle ABE$] \checkmark

$\therefore \angle EAD = 60^\circ + 48^\circ$ [adjacent \angle 's]

$\angle EAD = 108^\circ$ \checkmark

iii) $\triangle EDA$ is isosceles [two equal sides] \checkmark

$\therefore \angle EDA = \angle DEA$ [base \angle 's of isos $\triangle EDA$]

$\angle EDA = 180^\circ - \angle DEA - \angle EAD$ [\angle sum of $\triangle EDA$]

$$2\angle EDA = 72^\circ$$

$$\therefore \angle EDA = 36^\circ \quad \checkmark$$

Question 10

a)
$$\frac{x+5}{6} - \frac{x+1}{9} = \frac{x+3}{4}$$

$$6(x+5) - 4(x+1) = 9(x+3) \quad \checkmark$$

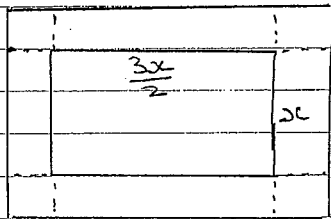
$$6x + 30 - 4x - 4 = 9x + 27 \quad \checkmark$$

$$2x + 26 = 9x + 27$$

$$7x = -1$$

$$x = \frac{-1}{7} \quad \checkmark$$

b) let the width of the pool be x .



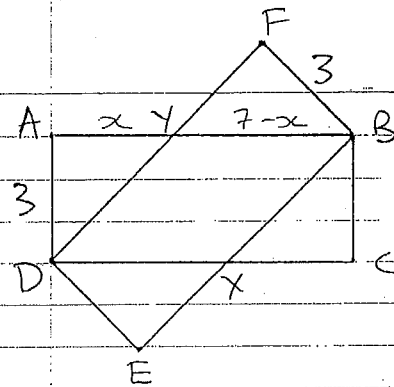
Area of path = $(2) \left(\frac{3x}{2} \right) (1) + 2(x)(1) + 4$

$\therefore 44 = 3x + 2x + 4$
 $5x = 40$
 $x = 8 \quad \checkmark$

\therefore Area of water surface = $\left(\frac{3x}{2} \right) (x)$
 $= \frac{(3 \times 8)(8)}{2}$
 $= 3(32)$
 $= 96 \text{ m}^2 \quad \checkmark$

\therefore Area of water surface is $96 \text{ m}^2 \quad \checkmark$

c) i)



let $AY = x$
 $\therefore YB = 7 - x$

In Δ 's YAD, YFB
 $AD = FB$ [given]
 $\angle AYD = \angle FYB$ [vert. opp. \angle 's]
 $\angle YAD = \angle YFB = 90^\circ$ [given]
 $\therefore \Delta YAD \equiv \Delta YFB$ [AAS] \checkmark
 $DY = BY$ [matching sides of congruent Δ 's]

Now, $DY^2 = x^2 + 3^2$
 $DY^2 = x^2 + 9$

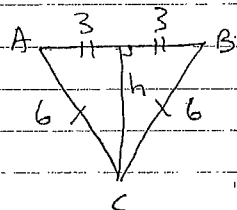
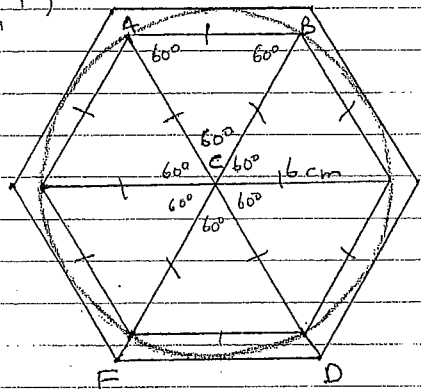
As $DY = BY$
 $DY^2 = BY^2$
 $\therefore x^2 + 9 = (7 - x)^2 \quad \checkmark$
 $x^2 + 9 = 49 - 14x + x^2$
 $14x = 40$
 $x = \frac{20}{7}$

$\therefore AY = \frac{20}{7}$ units \checkmark Q.E.D.

$$\begin{aligned} \text{ii) } YB &= 7 - \frac{20}{7} \\ &= \frac{29}{7} \end{aligned}$$

$$\begin{aligned} \text{Area } DXBY &= 3 \left(\frac{29}{7} \right) \\ &= \frac{87}{7} \text{ units}^2 \quad \checkmark \quad \left[\text{or } 12\frac{3}{7} \right] \end{aligned}$$

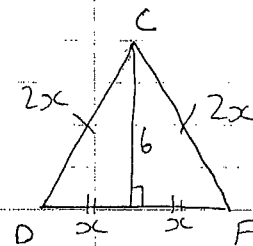
a) i)



$$\begin{aligned} h^2 &= 6^2 - 3^2 \\ h^2 &= 36 - 9 \\ h^2 &= 27 \\ h &= \sqrt{27} \quad \checkmark \end{aligned}$$

$$\begin{aligned} \therefore \text{Area of inscribed hexagon} &= 6 \times \frac{1}{2} (6)(\sqrt{27}) \\ &= 18\sqrt{27} \text{ cm}^2 \quad \checkmark \end{aligned}$$

ii)



$$\begin{aligned} (2x)^2 &= x^2 + 6^2 \\ 4x^2 &= x^2 + 36 \\ 3x^2 &= 36 \\ x^2 &= 12 \\ x &= \sqrt{12} \quad \checkmark \end{aligned}$$

$$\begin{aligned} \therefore \text{Area of circumscribed hexagon} &= 6 \times \frac{1}{2} (2)(\sqrt{12})(6) \\ &= 36\sqrt{12} \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \therefore \text{Area circ. hex} : \text{Area inscrib. hex} &= 36\sqrt{12} : 18\sqrt{27} \\ &= 2\sqrt{12} : \sqrt{27} \quad \checkmark \end{aligned}$$

$$[\text{OR } 4 : 3]$$

$$\begin{aligned} \text{Also, by similarity; sides} &= 6 : \sqrt{27} \\ \text{areas} &= 36 : 27 \\ &= 4 : 3 \end{aligned}$$

13