



2013 Annual Examination

FORM II MATHEMATICS

Tuesday 5th November 2013

QUESTION ONE (13 marks) Start a new page.

(a) Calculate:

(i) $3 + 2 \times (-4)$

(ii) $1 - \frac{2}{7}$

(iii) $4.2 \div 3$

(iv) $6 \times \frac{2}{3}$

(b) Calculate:

(i) 30% of \$60

(ii) $\frac{1}{3} + \frac{1}{4}$

(c) Simplify:

(i) $5p + 1 - p$

(ii) $x^5 \div x^3$

(d) Factorise:

(i) $8 + 2m$

(ii) $15p^2 - 20p$

(e) All squares are rectangles. True or False?

(f) Evaluate $5 - 3a$ when $a = -4$.

(g) Simplify $14 : 21$.

General Instructions

- Writing time — 2 hours
- Write using black or blue pen.
- Calculators are not to be used.

Total — 130 Marks

- All questions may be attempted.
- All necessary working should be shown.
- Start each question on a new page.

Collection

- Write your name, class and master on each page of your answers.
- Staple your answers in a single bundle.
- Write your name and master on this question paper and submit it with your answers.

2A: BR	2B: REJ	2C: LYL	2D: SG
2E: GMC	2F: PKH	2G: MLS	2H: SO
2I: LRP	2J: DNW		

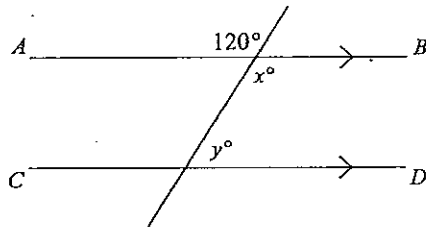
Checklist

- Writing paper required.
- Candidature — 190 boys

Examiner
GMC

QUESTION TWO (13 marks) Start a new page.

- (a) Expand and simplify $3(1 - 2p) + 4$.
- (b) Solve $2 + 3x = 14$.
- (c) (i) Solve $2x - 1 \leq 5$.
 (ii) Graph your answer to part (i) on a number line.
- (d) Calculate the area of a circle with radius 10 cm. Use the approximation $\pi \doteq 3.14$.
- (e) In the diagram below, $AB \parallel CD$.

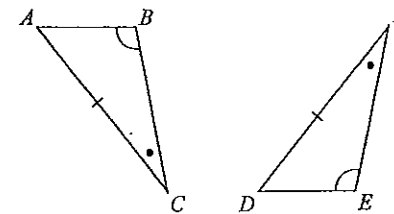


Find the value of x and y , giving reasons.

- (f) Calculate the number of minutes in 2.8 hours.
- (g) Write down the coordinates of the point four units directly above the point $(2, -3)$.
- (h) A square has side length $2x$ units. Write an expression for:
 - (i) the perimeter of the square.
 - (ii) the area of the square.

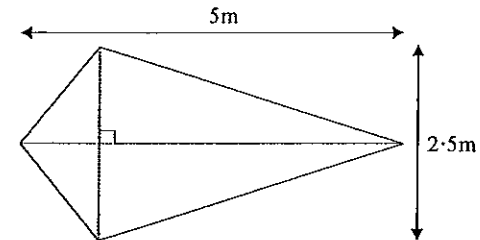
QUESTION THREE (13 marks) Start a new page.

- (a) Name the three quadrilaterals whose diagonals intersect at right angles.
- (b) Increase \$3 by 70%.
- (c) Consider the two triangles in the diagram below.



Which of the four congruence tests could be used to justify that $\triangle ABC \cong \triangle DEF$?

(d)

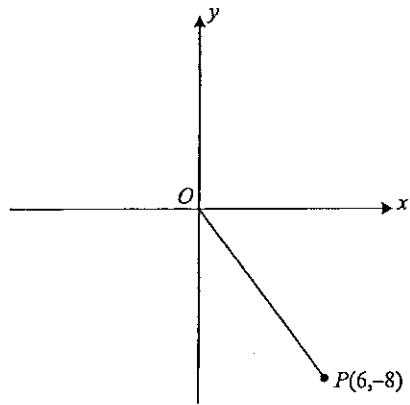


Find the area of the kite in the diagram above.

- (e) A bag contains red and blue marbles in the ratio 4 : 5. If there are 45 blue marbles in the bag, calculate the number of red marbles.
- (f) Divide 2km in the ratio 3 : 5.
- (g) Determine by substitution whether the point $(7, -12)$ lies on the line $y = -2x + 5$.

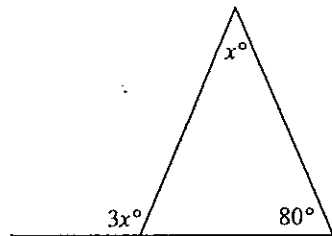
QUESTION FOUR (13 marks) Start a new page.

- (a) Write $\frac{3}{8}$ as a percentage.
- (b) Simplify $\frac{2}{3} : \frac{5}{6}$.
- (c) The base of a triangle is 6 cm and its area is 21 cm^2 . Calculate the perpendicular height of the triangle.
- (d) In the diagram below, the coordinates of point P are $(6, -8)$.



Calculate the distance of P from the origin.

- (e) A tap is dripping at a rate of 12 L per day. Express this rate in mL per hour.
- (f)



In the diagram above, find the value of x , giving reasons.

- (g) Solve $4x + 1 = 2x$.

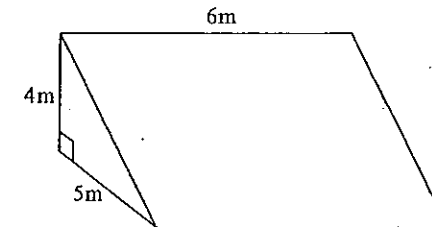
QUESTION FIVE (13 marks) Start a new page.

- (a) (i) Copy the table below to your answer sheet and fill it in according to the rule $y = 3 - 2x$.

x	0	1	2
y			

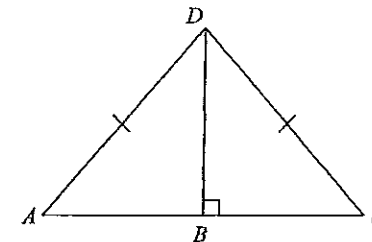
- (ii) Hence graph the line $y = 3 - 2x$ on a set of axes.

- (b)



Find the volume of the triangular prism in the diagram above.

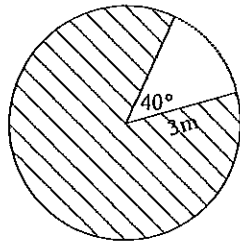
- (c) Solve $2(x + 3) - 4(x - 1) = 5$.
- (d) The sum of three consecutive odd numbers is 219. Let the first number be x .
 - (i) Show that $3x + 6 = 219$.
 - (ii) Hence find the three numbers.
- (e) In the diagram below, $AD = CD$ and $\angle CBD = 90^\circ$.



Prove that $\triangle ABD \cong \triangle CBD$.

QUESTION SIX (13 marks) Start a new page.

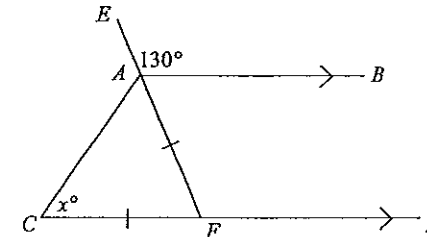
(a) Consider the shaded sector in the diagram below.



- (i) Show that the area of this sector is $\frac{8}{9}$ of the area of the full circle.
 - (ii) Hence calculate the area of the shaded sector. Leave your answer in exact form.
- (b) A computer shop has a 40% off sale. If Bianca paid \$450 after the discount for her computer, calculate the amount of money she saved.
- (c) Solve the following equations:
- (i) $4(2 - x) = -3(3 - 2x)$
 - (ii) $\frac{5x}{7} = \frac{x}{2} - 1$
- (d) Solve $\frac{5 - 4x}{2} > x$.
- (e) 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.

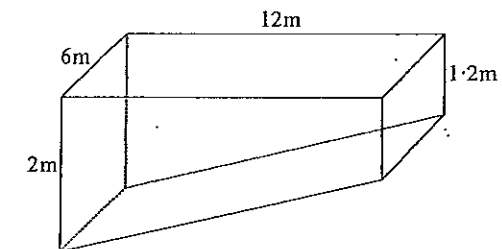
QUESTION SEVEN (13 marks) Start a new page.

- (a) Two cars are 10 km apart on a straight road and moving in the same direction. The car in front is travelling at 60 km/h and the car behind is travelling at 90 km/h.
- (i) Calculate how long it takes for the two cars to meet.
 - (ii) Hence calculate the distance the slower car travels before the two cars meet.
- (b) Expand and simplify $(a + b)^2 - (a - b)^2$.
- (c) Express $\frac{ab^2}{2c} - 2c$ as a single fraction.
- (d) In the diagram below, $AB \parallel CD$, $AF = CF$ and $\angle EAB = 130^\circ$.



Find the value of x , giving reasons.

- (e) A swimming pool is in the shape of a trapezoidal prism, as shown in the diagram below.

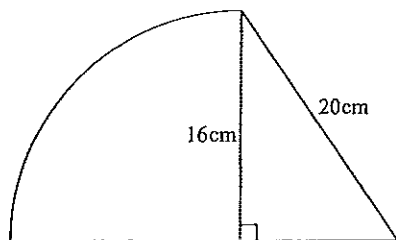


NOT TO SCALE

- (i) Show that the area of the cross section of the pool is 19.2m^2 .
- (ii) Hence calculate the capacity of the pool in litres. Note: $1\text{m}^3 = 1000\text{L}$.

QUESTION EIGHT (13 marks) Start a new page.

- (a) A right-angled triangle has two sides of length 2 cm and 3 cm. Give two possibilities for the length of the third side. Leave your answers in exact form.
- (b) A shape is comprised of a quarter circle and a right-angled triangle, as shown in the diagram below.

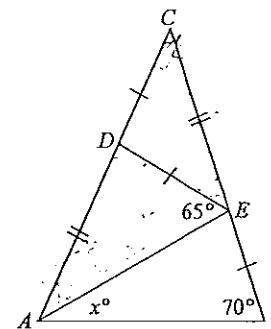


Calculate the exact perimeter of the shape.

- (c) Solve $\frac{2}{3x} = 1 - \frac{5}{2x}$.
- (d) The length and breadth of a rectangular TV screen are in the ratio 9 : 4. If the area of the screen is 8100 cm^2 , calculate the perimeter of the screen.
- (e) The ratio of boys to girls enrolled in a university course is 4 : 7. If there are 24 more girls than boys, calculate the number of students enrolled in the course.

QUESTION NINE (13 marks) Start a new page.

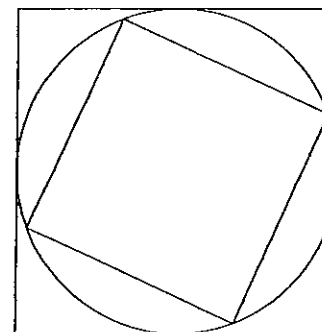
- (a) Simplify $\frac{p-q}{2q-2p}$.
- (b) Solve $\frac{1}{1+\frac{1}{x}} = 2$.
- (c) In the diagram below $AD = CE$, $CD = DE = EB$, $\angle ABC = 70^\circ$ and $\angle AED = 65^\circ$.



NOT TO SCALE

Find the value of x , giving reasons.

- (d) A small square is circumscribed by a circle which in turn inscribes a larger square, as shown in the diagram below.

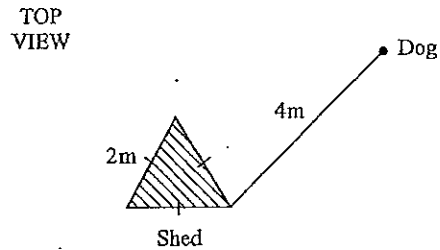


If the area of the smaller square is 4 cm^2 , calculate the area of the larger square.

- (e) Calculate $\frac{(2a^2b)^5}{a^8b^7}$ when $a = -\frac{3}{4}$ and $b = 1\frac{1}{2}$.

QUESTION TEN (13 marks) Start a new page.

- (a) Use the result $X^2 - Y^2 = (X - Y)(X + Y)$ to answer parts (i) and (ii) below. You do NOT need to prove this result.
- (i) Show that $5423^2 - 4577^2 = 8\,460\,000$.
 - (ii) Explain why 9919 is not a prime number.
- (b) A metal cube of side length 3 units is melted down and used to make small metal cylinders each of height 1 unit and diameter 1 unit.
- (i) Calculate the volume of one of the cylinders. Give your answer in exact form.
 - (ii) Hence calculate the maximum number of cylinders that can be made from the metal cube. Give your answer as a whole number.
- (c) Andrew walks an 18km straight course at a constant speed of 5 km/h. Barry runs the same course at a constant speed of 12km/h. When Barry reaches the finish, he turns around and runs back to Andrew. Barry then turns around and runs back to the finish. Barry repeats this pattern until Andrew finishes the course. How much further did Barry travel compared with Andrew?
- (d) A triangular garden shed in a large backyard has sides 2 m long as shown in the diagram below. A dog is tied with a 4 metre long rope to one of the corners of the shed.



- (i) Copy the diagram above carefully and illustrate the area of the yard in which the dog can play.
- (ii) Calculate the area in which the dog has to play.

END OF EXAMINATION

- 1 a) i) $3 + 2x(-4) = -5$ ✓
 ii) $1 - \frac{2}{7} = \frac{5}{7}$ ✓
 iii) $4 \cdot 2 \div 3 = 1.4$ ✓
 iv) $6 \times \frac{2}{3} = 4$. ✓
 b) i) 30% of \$60 = \$18 ✓
 ii) $\frac{1}{3} \div \frac{1}{4} = \frac{4}{3}$ ✓
 c) i) $5p + 1 - p = 4p + 1$ ✓
 ii) $x^5 \div x^3 = x^2$ ✓
 d) i) $8 + 2m = 2(4 + m)$ ✓
 ii) $15p^2 - 20p = 5p(3p - 4)$ ✓
 e) TRUE ✓
 f) $5 - 3x(-4) = 17$ ✓
 g) $14:21 = 2:3$ ✓

2 a) $3(1 - 2p) + 4 = 3 - 6p + 4$
 $= 7 - 6p$ ✓
 b) $2 + 3x = 14$
 $3x = 12$
 $x = 4$ ✓

c) i) $2x - 1 \leq 5$
 $2x \leq 6$ ✓
 $x \leq 3$ ✓



d) $A = \pi r^2$
 $= 3.14 \times 10^2$
 $= 314 \text{ cm}^2$ //

e) $x = 120^\circ$ (vert. opp. angles)
 $y = 60^\circ$ (cor. angles, $AE \parallel CD$)

✓ ✓ must have 2 correct angles
 ✓ ✓ 2 correct angles & 2 correct reasons.

f) $2\frac{2}{3}$ hours = $2 \times 60 + 4 \times 12$
 $= 168$ minutes. ✓

g) (2, 1) ✓

h) i) $8x$ units ✓
 ii) $4x^2$ units ✓

NB Award full marks for non-emptified response

DEDUCTIONS

- 3 d) deduct 1 mark for missing or incorrect units
 8 b) deduct 1 mark for not calculating exact area
 6 e.ii) deduct 1 mark for angle outside of 2° tolerance

- 8) a) square, rhombus, kite
 ✓ for one or two
 ✓✓ for three
- b) 10% of \$3 = \$0.30
 70% of \$3 = \$2.10
 \$3 + \$2.40 = \$5.10 //
- c) AAS ✓
- d) Area = $\frac{1}{2} \times 5 \times 2.5$
 = 6.25 m² ✓
 (DEDUCT 1 MARK FOR MISSING UNITS)
- e) 5 parts = 45
 1 part = 9
 4 parts = 36
 So there are 36 red marbles //
- f) 8 parts = 2000m
 1 part = 250m
 3 parts = 750m
 5 parts = 1250m ✓
 So the ratio is 750m : 1250m
- g) $y = -2x + 5$
 LHS = -12
 RHS = $-2(7) + 5$
 = -9
 LHS \neq RHS
 So, (7, -12) does not lie on the line ✓

- 9) a) $\frac{1}{8} = 12.5\%$ ✓
 $\frac{3}{8} = 37.5\%$ ✓
- b) $\frac{2}{3} : \frac{5}{6} = 4:5$ ✓
- c) $A = \frac{1}{2} \times b \times h$
 $21 = \frac{1}{2} \times 6 \times h$ ✓
 $21 = 3h$
 $h = 7$
 So, prop. height = 7 cm ✓
- d) $OP^2 = 6^2 + 8^2$ ✓
 $OP^2 = 100$
 $OP = 10$ units ✓
- e) 12 L/day = 12000 mL/day
 = 500 mL/h ✓
- f) $3x = x + 80$ (ext. L is sum of int. L's)
 $2x = 80$ ✓
 $x = 40$ ✓
- g) $4x + 1 = 2x$
 $2x + 1 = 0$
 $2x = -1$
 $x = -\frac{1}{2}$ //

- 5) a) i) $y = 3 - 2x$
- | | | | |
|---|---|---|----|
| x | 0 | 1 | 2 |
| y | 3 | 1 | -1 |
- ii)
- DEDUCT 1 MARK FOR SLOPPY WORK OR MISSING AXIS LABELS. X-INTERCEPT NOT REQUIRED
- b) $V = \frac{1}{2} \times l \times b \times h$
 = $\frac{1}{2} \times 4 \times 5 \times 6$ ✓
 = 60 m³ ✓
- c) $2(x+3) - 4(x-1) = 5$
 $2x + 6 - 4x + 4 = 5$ ✓
 $-2x + 10 = 5$
 $-2x = -5$
 $x = \frac{5}{2}$ ✓
- d) i) let the first number be x
 $x + (x+2) + (x+4) = 219$
 $3x + 6 = 219$ ✓
- ii) $3x = 213$ ✓
 $x = 71$ ✓
 So the numbers are 71, 73, 75
- e) AD = CD (given)
 DB common
 $\angle DBA = 90^\circ$ (straight angle) ✓
 $\angle DBA = \angle DBC$
 $\triangle ABD \equiv \triangle CBD$ (RHS) ✓

- 6) a) i) $\frac{360-40}{360} = \frac{320}{360}$
 = $\frac{8}{9}$ ✓
 So the sector is $\frac{8}{9}$ the area of the circle.
- ii) $A = \frac{8}{9} \times \pi \times 3^2$
 = 8π m² ✓
- b) let the original price be x
 $0.6 \times x = 450$
 $x = 450 \div 0.6$
 = 750
 So she saved \$300 ✓
- c) i) $4(2-x) = -3(3-2x)$
 $8 - 4x = -9 + 6x$ ✓
 $-10x = -17$
 $x = \frac{17}{10}$ ✓
- ii) $\frac{5x}{7} = \frac{x}{2} - 1$
 $10x = 7x - 14$ ✓
 $3x = -14$
 $x = -\frac{14}{3}$ ✓
- d) $\frac{5-4x}{2} > x$
 $5-4x > 2x$ ✓
 $5-6x > 0$
 $-6x > -5$
 $x < \frac{5}{6}$ ✓
- e) i) ✓ } see above sheet.
 ii) ✓ }
- TOLERANCE OF 2° FOR 6 e ii)

7 a) i) Difference in speed: 30 km/h
 30 km takes 1 hour ✓
 10 km takes 20 min ✓
 So it takes 20 min to meet.

ii) 60 km takes 1 hour
 20 km takes 20 min.
 So the slower car travels 20 km ✓

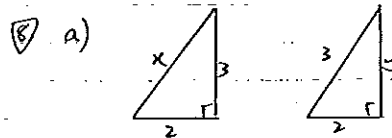
b) $(a+b)^2 - (a-b)^2$
 $= a^2 + 2ab + b^2 - (a^2 - 2ab + b^2)$ ✓
 $= 4ab$ ✓

c) $\frac{ab^2}{2c} - 2c = \frac{ab^2 - 4c^2}{2c}$ //

d) $\angle EFD = 130^\circ$ (Corresponding \angle s, $AB \parallel CD$)
 $\angle CAF = x^\circ$ (base \angle s isos Δ) ✓
 $x+x = 130$ (ext $\angle =$ sum of opp. interior \angle s) ✓
 $x = 65$ ✓

e) i) $A = \frac{12 \times 2}{2} \times 12$
 $= 144 \text{ m}^2$ ✓

ii) $V = 144 \times 6$
 $= 1152 \text{ m}^3$ ✓
 $= 115200 \text{ L}$ ✓



a) $x^2 = 2^2 + 3^2$ $y^2 = 3^2 + 2^2$
 $x = \sqrt{13}$ ✓ $y = \sqrt{13}$ ✓
 So the length could be $\sqrt{13}$ cm or $\sqrt{5}$ cm

b) let base of triangle be x
 $x^2 + 16 = 20^2$
 $x = 12$

$P = 12 + 20 + 16 \cdot \frac{1}{4} \times 2 \times \pi \times 16$
 $= 48 + 8\pi \text{ cm}$ ✓
 (DEDUCT 1 MARK FOR APPROXIMATION)

c) $\frac{2}{3x} = 1 - \frac{5}{2x}$
 $4 = 6x - 15$ } various methods possible
 $19 = 6x$
 $x = \frac{19}{6}$ ✓✓✓

d) let length be $9x$, breadth be $4x$
 $9x \times 4x = 8100$ ✓
 $36x^2 = 8100$
 $x^2 = 225$
 $x = 15$ ✓
 so length = 135, breadth = 60
 $P = 135 \times 2 + 60 \times 2$
 $= 390 \text{ cm}$ ✓

e) 3 parts = 24
 1 part = 8
 11 parts = 88
 so 88 pupils in total. ✓✓
 (other methods acceptable)

9 a) $\frac{p-q}{2q-2p} = \frac{p-q}{-2(q-p)}$
 $= -\frac{1}{2}$ ✓

b) $\frac{1}{1 + \frac{1}{x}} = 2$ } various methods possible
 $1 + \frac{1}{x} = \frac{1}{2}$
 $\frac{1}{x} = -\frac{1}{2}$
 $x = -2$ ✓✓

c) $\begin{cases} \angle CAB = 70^\circ \text{ (base } \angle \text{s of isos } \Delta) \\ \angle ACB = 40^\circ \text{ (angle sum of } \Delta) \\ \angle CED = 40^\circ \text{ (base } \angle \text{s of isos } \Delta) \\ x + 70 = 105 \text{ (external } \angle = \text{sum of opp. interior } \angle \text{s)} \end{cases}$
 $x = 35$ ✓

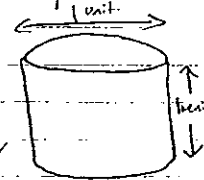
d) Side length of small square = 2
 Let d be diagonal of small square
 $d^2 = 2^2 + 2^2$
 $d = \sqrt{8}$ ✓
 So side length of large square = $\sqrt{8}$ ✓
 So area large square = $(\sqrt{8})^2$
 $= 8 \text{ cm}^2$ ✓

e) $\frac{(2a^2b)^5}{a^8b^7} = \frac{32a^{10}b^5}{a^8b^7}$
 $= \frac{32a^2}{b^2}$ ✓
 $= 32 \left(-\frac{3}{4}\right)^2$
 $= 32 \left(\frac{3}{4}\right)^2$
 $= 32 \times \left(-\frac{3}{2}\right)^2$
 $= 8$ ✓✓

10 a) $x^2 - y^2 = (x-y)(x+y)$
 i) $5423^2 - 4577^2$
 $= (5423 - 4577)(5423 + 4577)$
 $= 846 \times 10000$ ✓
 $= 8460000$ ✓

ii) $9919 = 10000 - 81$
 $= 100^2 - 9^2$
 $= 91 \times 109$ ✓✓
 So 9919 is not prime.

b) i) $r = \frac{1}{2}$
 $V = \pi \times \left(\frac{1}{2}\right)^2 \times 1$
 $= \frac{\pi}{4} \text{ unit}^3$ ✓



ii) Vol of cube = $3^3 = 27 \text{ cm}^3$
 $27 \div \frac{\pi}{4} = \frac{27 \times 4}{\pi}$
 $= \frac{108}{3.1}$ ✓

Long Division:

$$\begin{array}{r} 34 \\ 31 \overline{)1080} \\ \underline{93} \\ 150 \\ \underline{124} \\ 26 \end{array}$$

So 34 cylinders can be made. ✓

(MUST GIVE WHOLE NUMBER FOR MARK)

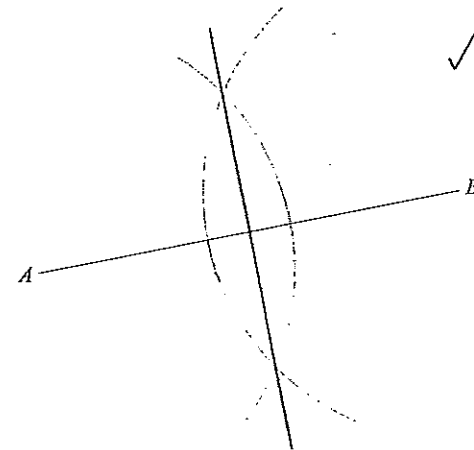
NAME: CLASS: MASTER:

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

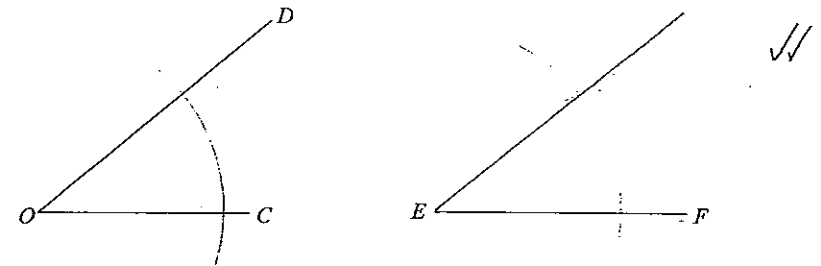
QUESTION SIX

(e) In the following questions leave all construction arcs and use only a ruler and compass.

(i) Construct a perpendicular bisector of interval AB.



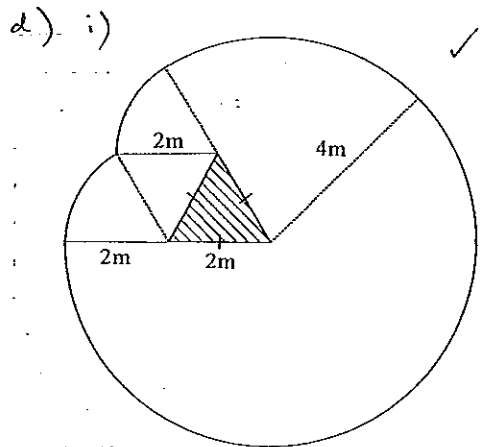
(ii) Copy the angle $\angle COD$ at one end of interval EF.



Must show construction marks.

c) $18 \div 5 = 3 \frac{3}{5}$
 So Andrew takes 3.6 hours to walk the course ✓
 $3.6 \times 12 = 43.2$
 So Barry runs 43.2 km in 3.6 hours ✓
 $43.2 - 18 = 25.2$
 So Barry travels 25.2 km further than Andrew ✓

Area of play area
 $= \frac{5}{6} \times \pi \times 4^2 + \frac{2}{6} \times \pi \times 2^2 + \sqrt{3}$
 $= \frac{40\pi}{3} + \frac{4\pi}{3} + \sqrt{3}$
 $= \frac{44\pi}{3} + \sqrt{3} \text{ m}^2$ ✓✓



sectors of radius 2 & 4cm must be clear.

ii) Area = $\frac{5}{6} \times$ circle radius 4
 $+ 2 \times \frac{1}{6} \times$ circle radius 2
 $+ 1 \times$ equilateral Δ with side length 2

Consider the equilateral triangle.
 Let perpendicular height be h

$$h^2 + 1^2 = 2^2$$

$$h^2 + 1 = 4$$

$$h^2 = 3$$

$$h = \sqrt{3}$$



So Area of triangle = $\frac{1}{2} \times 2 \times \sqrt{3}$