Name .... (   )   Secondary 3 ....

ANGLICAN HIGH SCHOOL
End-of-Year Examination
Secondary Three
MATHEMATICS (SYLLABUS D)
Section A

Wednesday   11 Oct 2006   45 minutes

Candidates answer on the question paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces provided on this cover page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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 in the space below that question.
Omission of essential working will result in loss of marks.
The total of the marks for this section is 35.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL
TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use
35

This question paper consists of 8 printed pages, including this cover page.
[Turn over

Section A [35 marks]
Answer **ALL** questions.
No calculators may be used in this section.

1(a) Evaluate $3^{-2} + (\frac{1}{7})^0$.

(b) Given $10T = \frac{7R^3}{4S}$, express R in terms of T and S.

(c) Solve the equation

$$\frac{x}{x+2} - \frac{2}{2x-5} = 0.$$

Answer (a) ________________ [1]

(b) ________________ [2]

(c) $x =$ ______ or ______ [3]

2(a) Solve the inequalities $4x-1 \leq x+5 \leq 3x+11$.

(b) Hence, find the smallest possible value of x^2.

Answer (a) ______________ [3]

(b) smallest x^2 = ______ [1]

3(a) Given that y varies inversely as x^2, and that the value of y is the same as x when $x = 3$, express y in terms of x.

(b) Hence find the value of y when $x = \frac{3}{2}$.

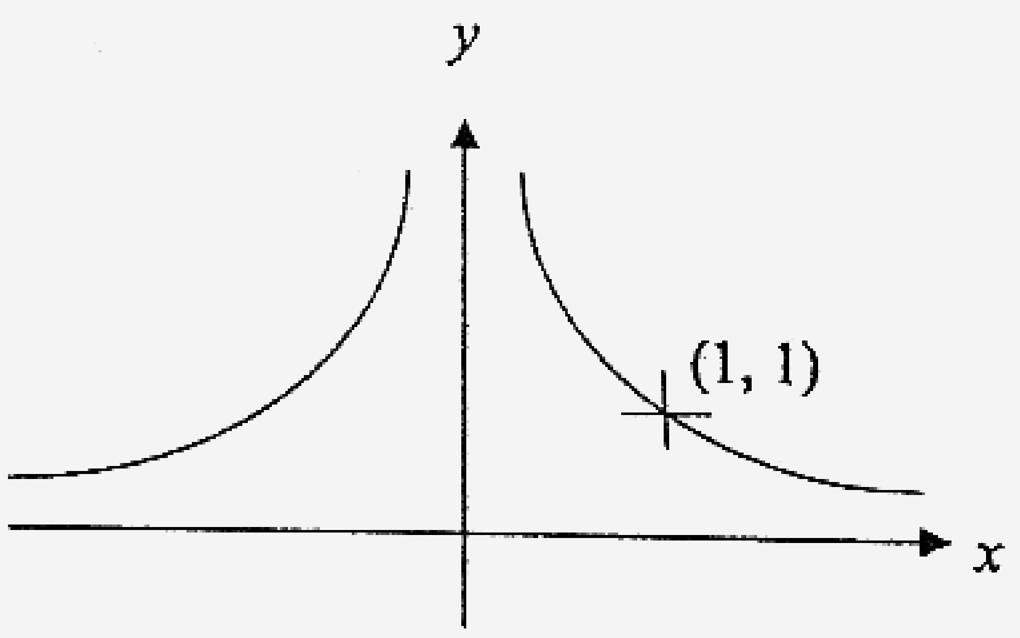
Answer (a) ______________ [2]

(b) y = ____________ [1]

[Turn over

4(a) The diagram shows the sketch of a graph. Write down a possible equation of the graph.

[1]

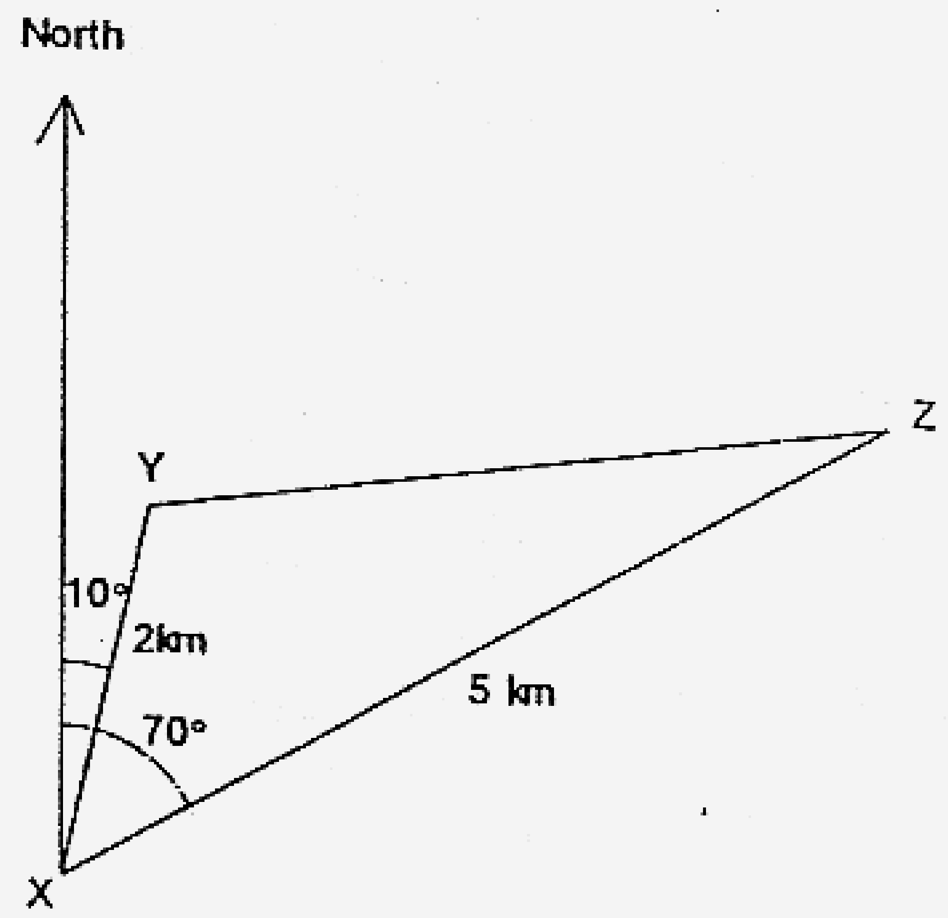


4(b) Given that the surface area of a cylinder A is 144 cm^2 and that of a similar cylinder B is 64 cm^2. Find the ratio of the volume of cylinder A to cylinder B as a fraction in its simplest form.

Answer (a) ________________ [1]

(b) ________________ [3]

5 In the diagram, X, Y and Z represent three resting points on an island. Y is 2km from X on a bearing of 010°. Z is 5km on a bearing of 070°. Using sin 60° = 0.866 and cos 60° = 0.5,



(a) Calculate the bearing of X from Z.

(b) Calculate the area of the triangle XYZ.

(c) Calculate the value of $(YZ)^2$.

Answer (a) ________________ ° [1]

(b) ________________ km^2 [2]

(c) ________________ km^2 [2]

[Turn over

6 In the diagram, B is the point (3,0) and E is the point (0,8). $\angle CAB = 45°$ and the gradient of the line BC is $-\dfrac{4}{3}$.

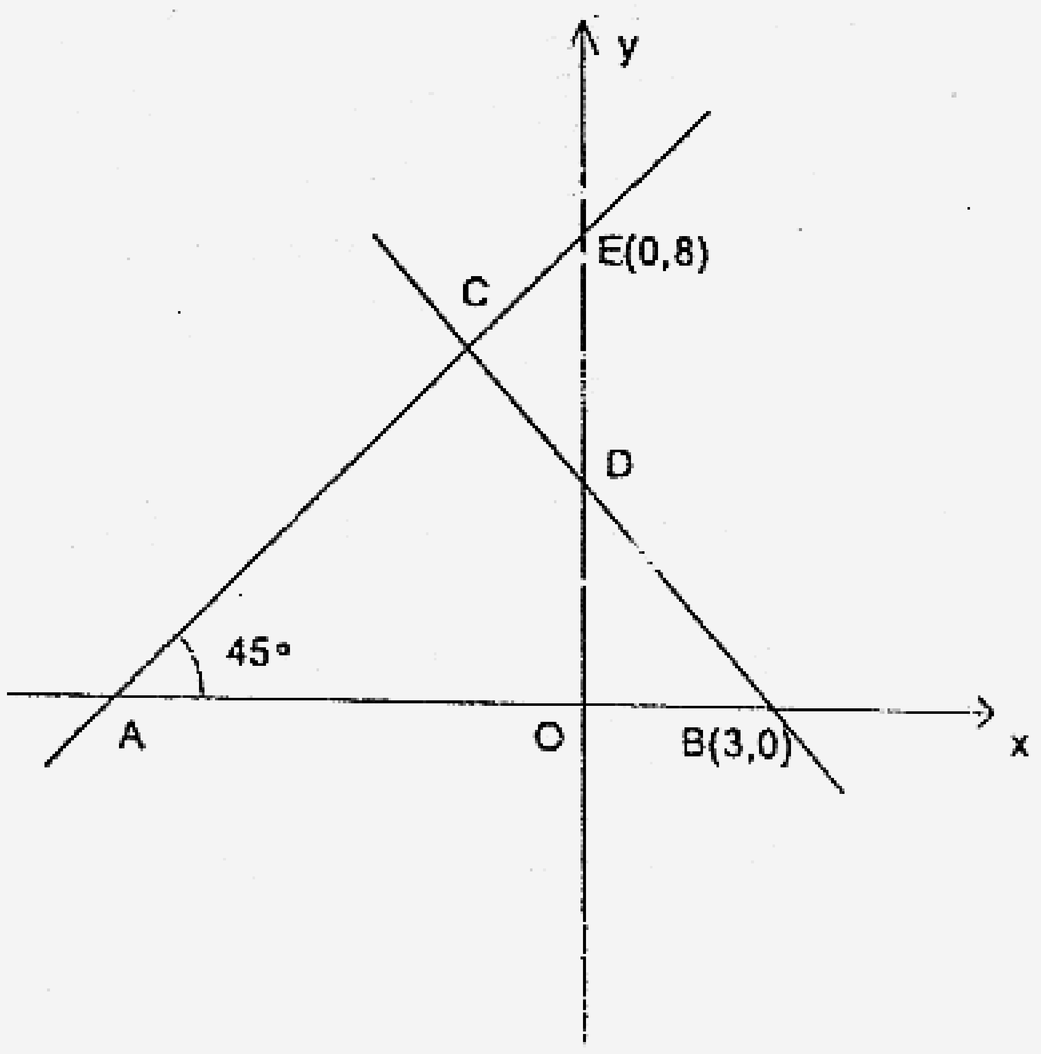
Find

(a) The gradient of the line AC.

(b) The equation of the line AC.

(c) The coordinates of the point D.

(d) The distance BD.



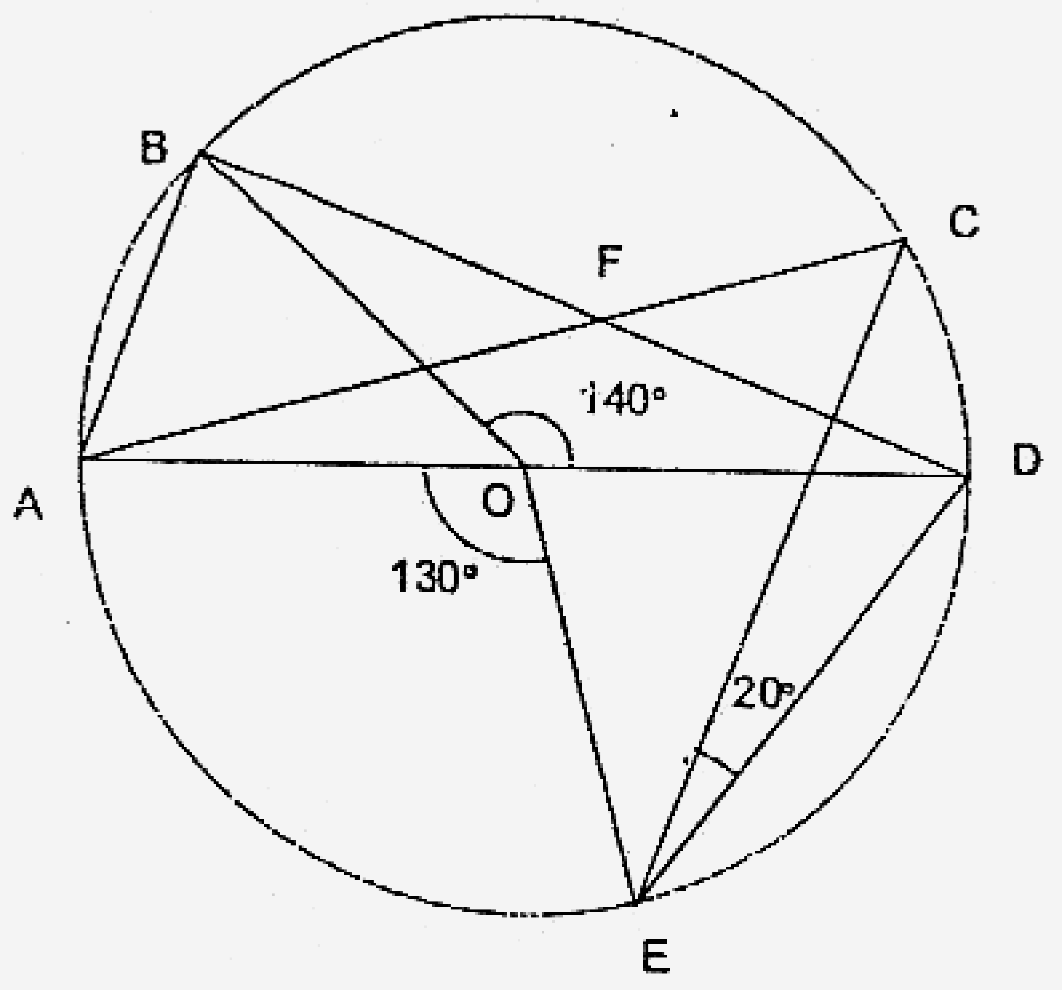
Answer (a) Gradient of AC = ____________ [1]

(b) Equation of line AC is ______________ [1]

(c) D = (________, ________) [1]

(d) BD = __________ units [1]

7 In the diagram, not drawn to scale, AD is the diameter of the circle with centre O. Given that $\angle AOE = 130°$, $\angle BOD = 140°$ *and* $\angle CED = 20°$.



(a) Find $\angle ABD$

(b) Find $\angle ACE$

(c) Find $\angle ADE$

(d) Explain why $\angle ODB = 20°$

Answer (a) ____________________° [1]

(b) ____________________° [1]

(c) ____________________° [1]

(d) ____

____

____ [1]

[Turn over

8 The diagram below shows 9 rectangular boxes. A piece of eraser is placed on one of the boxes. A fair dice is thrown. If 1, 2, 3 or 4 is thrown, the eraser is moved one box to the right. If 5 or 6 is thrown, the eraser is moved one box to the left.

		M		O	R		E	

(a) On the first game, the eraser is placed on the letter 'M'. The dice is thrown once. What is the probability that the eraser is moved to the left?

(b) On the second game, the eraser is now moved to the letter 'R'. This time the dice is thrown two times and the eraser is moved after every throw of the dice. Find the probability that the eraser finishes

(i) at E
(ii) at O
(iii) at R

Give your answers as a fraction in its simplest form.

Answer *(a)* ______________________ [1]

(b)(i) ______________________ [1]

(ii) ______________________ [1]

(iiii) ______________________ [2]

===== END OF SECTION A =====

Name .... (   )   Secondary 3

ANGLICAN HIGH SCHOOL
End-of-Year Examination
Secondary Three
MATHEMATICS (SYLLABUS D)
Section B

Wednesday   11 Oct 2006   1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Answer **all** questions.
Write your name, class and index number in the spaces provided on this mark sheet.
Attach this mark sheet to the first page of your answer scripts.
Write in dark blue or black pen on the paper provided.
You may use a pencil for any diagrams or graphs. Do not use paper clips, highlighters, glue or correction fluid.
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.
Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
You are expected to use an electronic 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.
The total of the marks for this section is **45**.

For Examiner's Use

Question	9	10	11	12	13	14
Marks						
					Marks for Section B	

GRAND TOTAL / 80

Section B [45 marks]
Answer ALL questions.

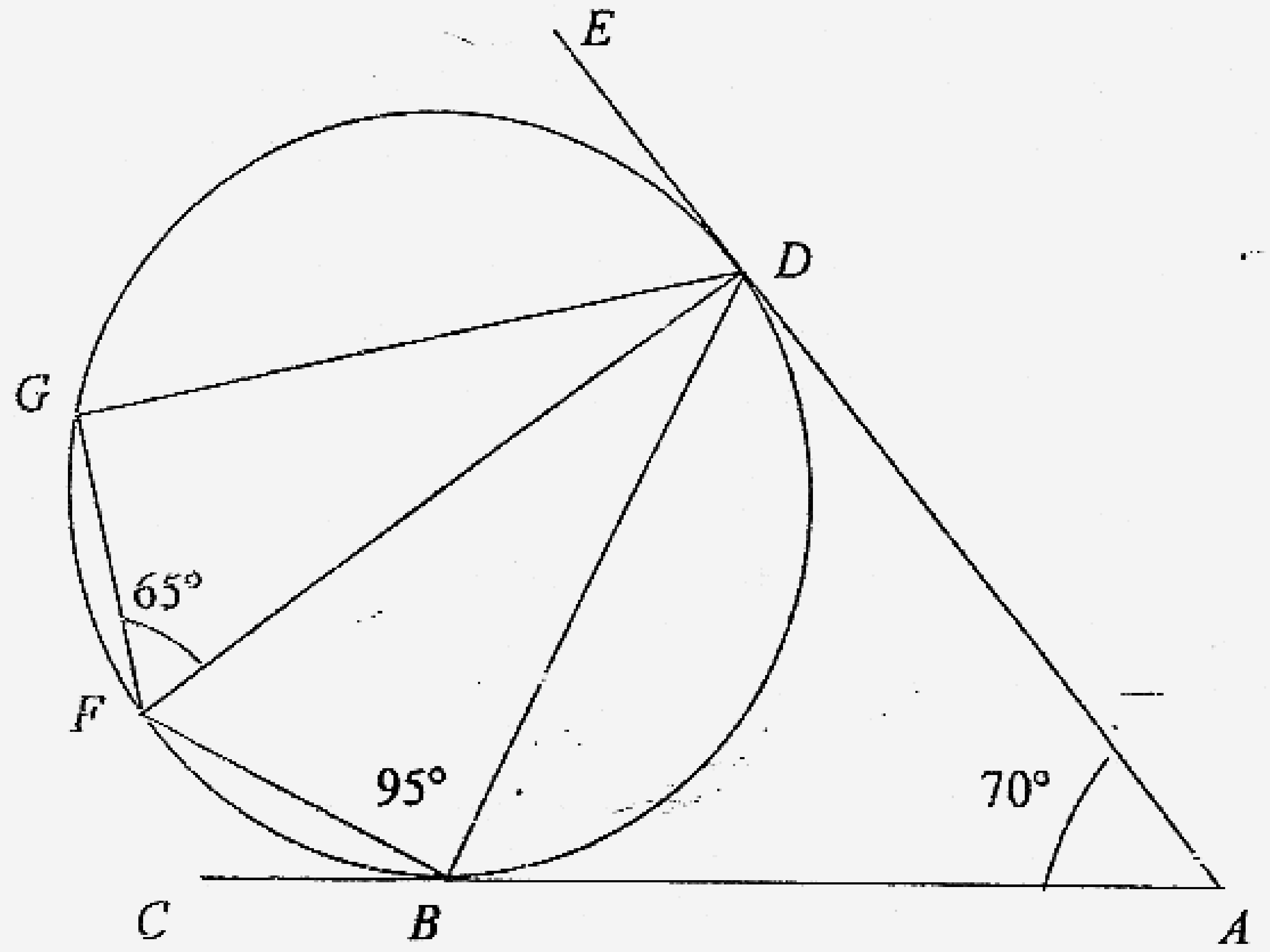
9. A square of side $3x$ m and a rectangle of sides $(5x - 1)$ m and $(3x + 2)$ m both have the same area.

(a) Form an equation in x and show that it reduces to $6x^2 + 7x - 2 = 0$. [2]

(b) By using the completing the square method, solve the equation $6x^2 + 7x - 2 = 0$. [5]

(c) Calculate the area. [1]

10. ABC and ADE are tangents to the circle at B and D respectively. DF is a straight line. $\angle DFG = 65°$, $\angle DBF = 95°$ and $\angle DAB = 70°$.



(a) What is the special name given to the quadrilateral $BDGF$? [1]

(b) Find, stating all reasons clearly,

(i) $\angle EDG$, [1]

(ii) $\angle ADB$, [1]

(iii) $\angle GFB$, [2]

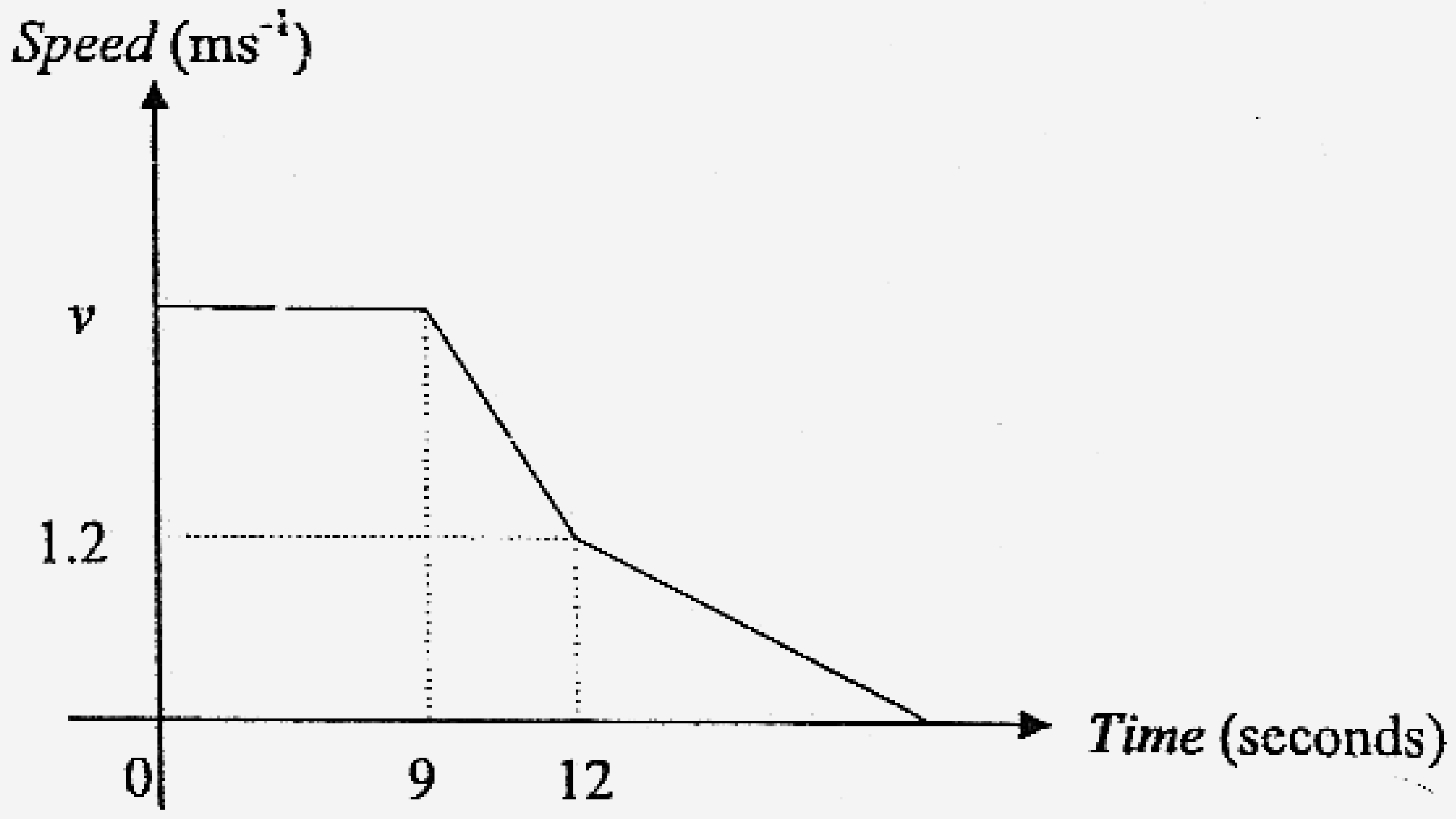
(iv) $\angle BDF$. [2]

11. The diagram shows a speed-time graph of a vehicle. From 0 to 9 seconds, the vehicle is travelling at uniform speed, v ms^{-1}. It is then uniformly retarded, or decelerated to 1.2 ms^{-1} for 3 seconds, and then retarded again at 0.2 ms^{-2} until it comes to a halt.

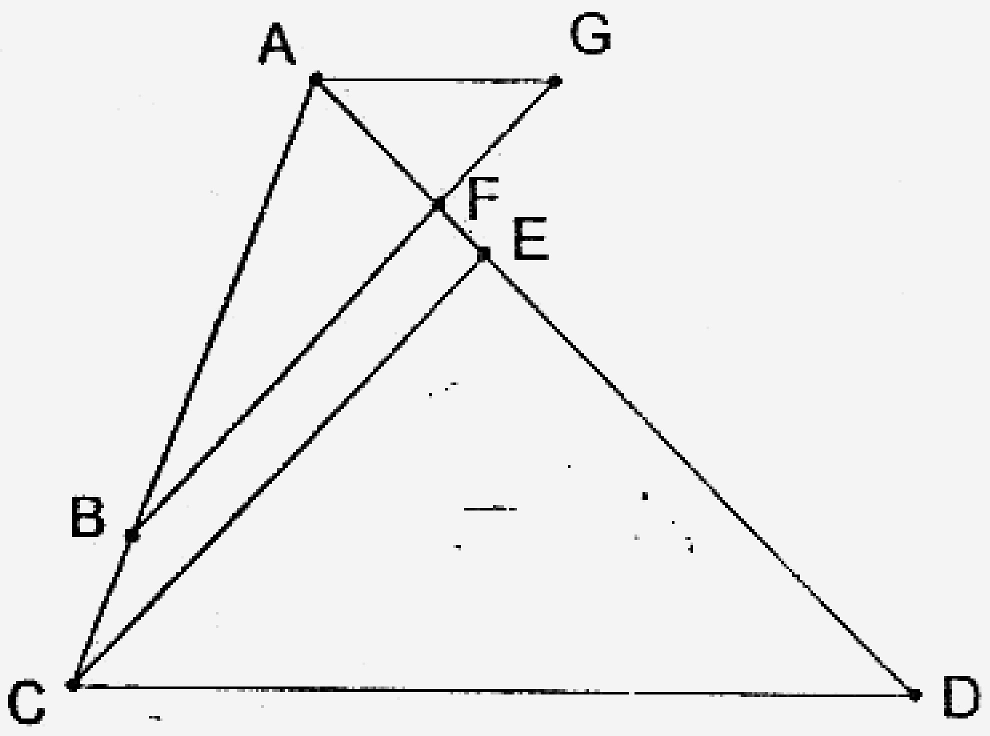
(a) If the distance travelled in the first 9 seconds is 18 m, calculate the value of v. [1]

(b) Calculate the deceleration from the 9th second to the 12th second. [1]

(c) Calculate the time when the vehicle comes to a halt. [2]



12. In the diagram AG is parallel to CD and $AG = \frac{2}{7}CD$. The point B on AC is such that $BC = \frac{2}{7}AC$. The line BG meets AD at F and the line through C parallel to BG meets AD at E.



(a) Prove that $\angle AFG = \angle DEC$. [2]

(b) Prove that triangle AGF is similar to triangle DCE. [2]

(c) Find the value of

(i) $\frac{FG}{EC}$ [1]

(ii) $\frac{BF}{CE}$ [1]

(iii) $\frac{\text{area of } \Delta AGF}{\text{area of } \Delta ABF}$ [2]

[Turn over

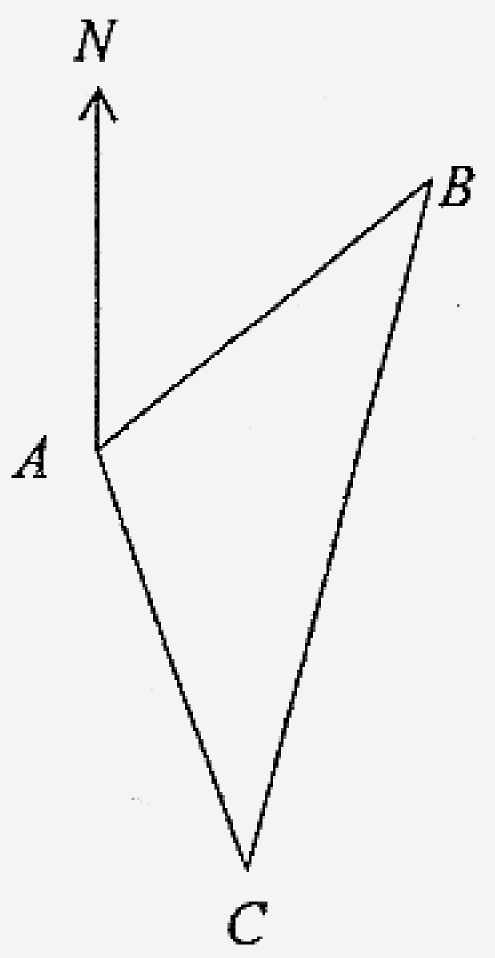
13. The sketch shows a map with three locations A, B and C, all on horizontal ground. A tall building is located at A. A house is located at B, and a bus stop is at C. The distance from A to B is 253 m, and the distance from B to C is 523 m. B is at a bearing of 053° from A and C is at a bearing of 215° from B.

(a) Show that $\angle ABC = 18°$ [2]

(b) Calculate the distance from A to C. [2]

(c) A man walks in a straight line from the house, at B to the bus stop at C. Find the shortest distance between the man and the building at A. [3]

(d) A woman in the building observes the man walking. If the woman is located 31 m above the ground, calculate the maximum angle of depression from the woman to the man. [2]



14. **Answer the whole of this question on a sheet of graph paper.**

Using 2 cm to represent 5 units on the y-axis and 2 cm to represent 1 unit on the x-axis, draw the graph of $y = 2x^2 - 4x - 7$ for $-3 \le x \le 4$ by using the table of values given below. [3]

x	−3	−2	−1	0	1	2	3	4
y	23	9	-1	-7	-9	-7	-1	9

Use your graph to find an estimate for

(a) (i) the solutions to the equation $2x^2 - 4x - 7 = 0$, [2]

(ii) the solutions to the equation $2x^2 - 4x = 9$, [2]

(b) the gradient of the tangent to the curve at the point where $x = 2.5$. [2]

=====END OF PAPER=====

Answer Key

Section A

1(a) $1\frac{1}{9}$

(b) $R = \sqrt[3]{\frac{40ST}{7}}$

(c) $x = -0.5$ or 4

2(a) $-3 \le x \le 2$

(b) 0

3(a) $y = \frac{27}{x^2}$

(b) $y = 12$

4(a) Possible solutions

$y = \frac{1}{x^{2k}}, k \in Z^+$

$y = \left|\frac{1}{x^{2k+1}}\right|, k \in Z^+$

(b) $\frac{27}{8}$

5(a) 250°

(b) 4.33km^2

(c) 19 km^2

6(a) 1

(b) $y = x + 8$

(c) D (0, 4)

(d) 5 units

7(a) 90°

(b) 65°

(c) 65°

(d) Triangle ODB is an isos. triangle.

8(a) $\frac{1}{3}$

(bi) $\frac{4}{9}$

8(bii) 0

8(biii) $\frac{4}{9}$

Section B

9(b) $x = 0.237, -1.40$

(c) 0.507 m^2

10(a) cyclic quadrilateral

(bi) 65°

(bii) 55°

(biii) 120°

(biv) 30°

11(a) 2

(b) $\frac{4}{15} m/s^2$

(c) 18th second

12(a)
$\angle AFG = \angle EFB (vert.opp \angle s)$
$\angle EFB = \angle DEC$
$(corr.\angle s, BF // CE)$
$\therefore \angle AFG = \angle DEC$

(b)
Since $\angle AFG = \angle DEC$ (proved)
and $\angle FAG = \angle EDC$ (alt.$\angle$s, AG//CD)
$\therefore \Delta AGF$ and ΔDCE are similar. (AA property)

(ci) $\frac{2}{7}$

(cii) $\frac{5}{7}$

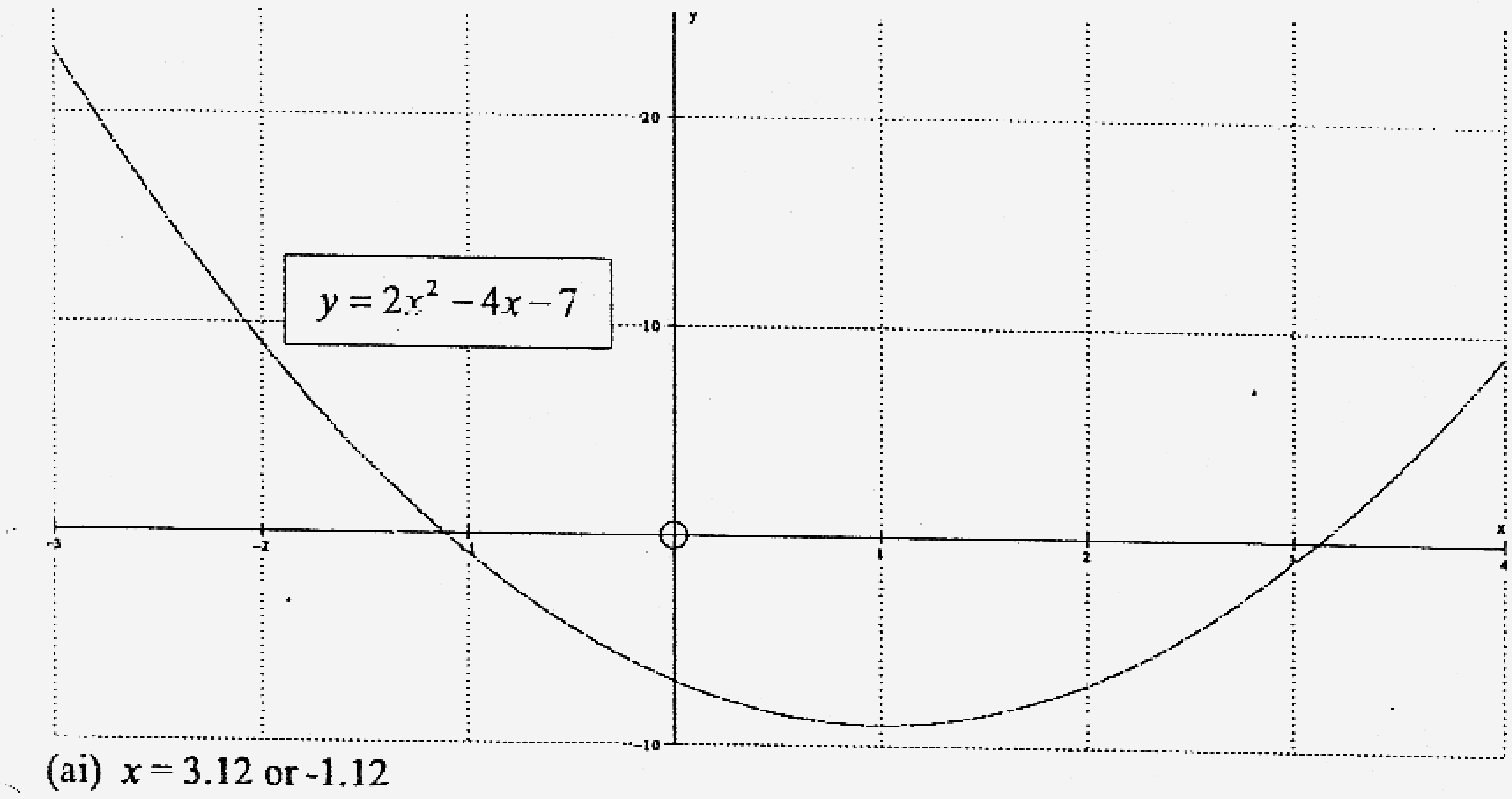
(ciii) $\frac{2}{5}$

13(b) 293m

(c) 78.2m

(d) 21.6°

14.



(ai) $x = 3.12$ or -1.12

(aii) x =3.35 or -1.35

(b) 6

Section A   EM FYE 2006

1(a) $3^{-2} + (\frac{1}{7})^0$

$= \frac{1}{3^2} + 1$

$= 1\frac{1}{9}$ #

(b) $10T = \frac{7R^3}{45}$

$450T = 7R^3$

$R^3 = \frac{450T}{7}$

$R = \sqrt[3]{\frac{450T}{7}}$ #

(c) $\frac{x}{x+2} - \frac{2}{2x-5} = 0$

$\frac{x(2x-5)-2(x+2)}{(x+2)(2x-5)} = \frac{0}{1}$

$2x^2 - 5x - 2x - 4 = 0$

$2x^2 - 7x - 4 = 0$ $2x + 1$

$(2x+1)(x-4) = 0$ $x - 4$

$x = -\frac{1}{2}$ # or $x = 4$ #

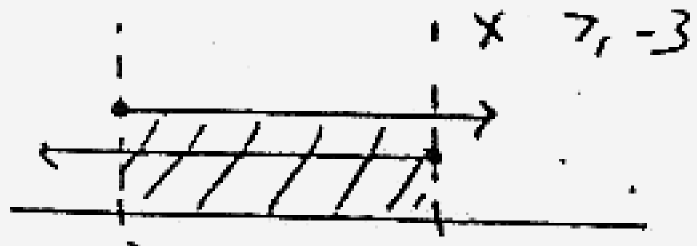
2(a)

$4x - 1 \leq x + 5$; $x + 5 \leq 3x + 11$

$3x \leq 6$; $-6 \leq 2x$

$x \leq 2$; $2x \geq -6$

$x \geq -3$



$\therefore -3 \leq x \leq 2$ #

(b) smallest $x^2 = 0$ #

3(a) $y \propto \frac{1}{x^2}$

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

$\frac{3}{1} = \frac{k}{3^2}$

$k = 27$

$\therefore y = \frac{27}{x^2}$ #

(b) when $x = \frac{3}{2}$

$y = \frac{27}{(\frac{3}{2})^2}$

$= 27 \times \frac{4}{9}$

$= 12$ #

4(a) Possible sol^ns.

$y = \frac{1}{x^{2k}}$, $k \in \mathbb{Z}^+$

$y = \left| \frac{1}{x^{2k+1}} \right|$, $k \in \mathbb{Z}^+$

Let A_1 & A_2 be area of cylinders

(b) A & B respectively.

$\frac{A_1}{A_2} = \frac{144}{64}$

$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2$

$\therefore \frac{l_1}{l_2} = \sqrt{\frac{144}{64}}$

$= \frac{12}{8}$

$= \frac{3}{2}$

$\therefore \frac{V_1}{V_2} = \left(\frac{3}{2}\right)^3$

$= \frac{27}{8}$

5(a) Bearing of X from Z

$= 70° + 180°$

$= 250°$

(b) Area of $\Delta XYZ = \frac{1}{2}(XY)(XZ)\sin 60°$

$= \frac{1}{2}(2)(5)(0.866)$

$= 4.33 \text{ km}^2$

(c) $(YZ)^2 = (XY)^2 + (XZ)^2 - 2(XY)(XZ)\cos 60°$

$= 2^2 + 5^2 - 2(2)(5)\cos 60°$

$= 4 + 25 - 10$

$= 19 \text{ km}^2$

6(a) Since $\angle CAB = 45°$

$\therefore$ Gradient of $AC = \tan 45°$

$= 1$

(b) Eq^n of line AC is

$y = 1x + 8$

$\therefore y = x + 8$

(c) Let $D = (0, y)$

$\frac{y - 0}{0 - 3} = -\frac{4}{3}$

$y = -\frac{4}{3}(-3)$

$= 4$

$\therefore D = (0, 4)$

(d) $BD = \sqrt{3^2 + 4^2}$

$= 5$ units

7(a)

$\angle ABD = 90°$ (rt $\angle$ in a semicircle)

(b) $\angle ACE = \frac{1}{2}(130°)$ ($\angle$ at centre $= 2\angle$ at Ov)

$= 65°$

(c) $\angle ADE = 65°$ ($\angle$ in same segment).

(d) ΔODB is an isosceles Δ.

8(a) P(Eraser is moved to the left)

$= \frac{2}{6}$

$= \frac{1}{3}$ *

(bi) P(Eraser finishes at E)

$= \frac{4}{6} \times \frac{4}{6}$

$= \frac{2}{3} \times \frac{2}{3}$

$= \frac{4}{9}$ *

(ii) P(Eraser finishes at O)

$= 0$ *

(iii) P(Remains at R)

= P(Eraser moves to O then R)
+ P(Eraser moves to the right then back to R)

$= \frac{2}{6} \times \frac{4}{6} + \frac{4}{6} \times \frac{2}{6}$

$= \frac{2}{9} + \frac{2}{9}$

$= \frac{4}{9}$ *

Section B

9(a) $(3x)^2 = (5x-1)(3x+2)$

$9x^2 = 15x^2 + 10x - 3x - 2$

$0 = 6x^2 + 7x - 2$

$6x^2 + 7x - 2 = 0$ (A)

(b) $x^2 + \frac{7}{6}x = \frac{1}{3}$

$x^2 + \frac{7}{6}x + \left(\frac{7}{12}\right)^2 = \frac{1}{3} + \left(\frac{7}{12}\right)^2$

$\left(x + \frac{7}{12}\right)^2 = \frac{97}{144}$

$x + \frac{7}{12} = \pm\sqrt{\frac{97}{144}}$

$x = -\frac{7}{12} \pm \sqrt{\frac{97}{144}}$

$= 0.2374, -1.404$

$\simeq 0.237, -1.40$ (3sf)

(c) Area $= (3 \times 0.2374)^2$

$= 0.5072$

$\simeq 0.507\ m^2$ *

10 (a) cyclic quadrilateral

(b i) $\angle EDG = 65°$ *
(∡ in alt. segment)

(ii) $\angle ADB = \frac{180° - 70°}{2}$
$= 55°$ *
(AB = AD ∵ tangents from an ext. pt)

(iii) $\angle GDB = 180° - 65° - 55°$
$= 60°$ (∡ on a straight line)

$\therefore \angle GFB = 180° - 60°$
$= 120°$ *
(opp ∠s of a cyclic quad)

$\angle FGD = 180° - 95° = 85°$ (opp ∡ of cyclic quad).

(iv) $\angle GDF = 180° - 85° - 65°$
$= 30°$ (∡ sum of a Δ)

$\therefore \angle BDF = 60° - 30°$
$= 30°$ *

11 (a) $v \times 9 = 18$
$\therefore v = 2$ *

(b) Acceleration $= \frac{1.2 - 2}{12 - 9}$
$= -\frac{4}{15}\ m/s^2$

$\therefore$ Deceleration $= \frac{4}{15}\ m/s^2$ *

(c) Acceleration $= \frac{0 - 1.2}{t - 12} = -0.2$

$\therefore -1.2 = -0.2t + 12(0.2)$
$0.2t = 3.6$
$t = 18$

The vehicle stops at the 18th second *

12 (a) $\angle AFG = \angle EFB$ (vert. opp ∠s)
$\angle EFB = \angle DEC$ (corr. ∠s, BF∥CE)

$\therefore \angle AFG = \angle DEC$

(b) Since $\angle AFG = \angle DEC$ (proved)
and $\angle FAG = \angle EDC$ (alt ∡s, AG ∥ CD)

$\therefore$ ΔAGF & ΔDCE are similar.
(AA property)

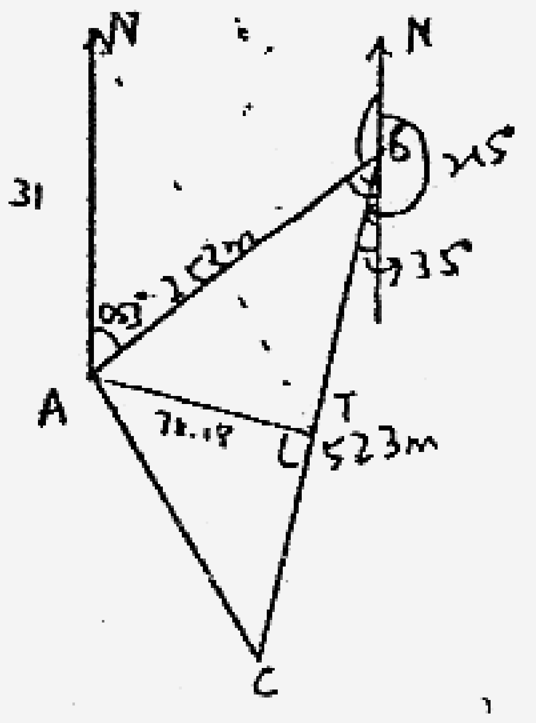
(c i) $\frac{FG}{EC} = \frac{AG}{DC}$ (similar Δs)
$= \frac{2}{7}$ *

(ii) ΔABF is similar to ΔACE
(BF ∥ CE)

$\therefore \frac{BF}{CE} = \frac{AB}{AC}$
$= \frac{5}{7}$ *

(iii) $\frac{FG}{BF} = \frac{FG}{EC} \times \frac{EC}{BF}$
$= \frac{2}{7} \times \frac{7}{5}$
$= \frac{2}{5}$

$\frac{\text{Area of } \Delta AGF}{\text{Area of } \Delta ABF} = \frac{FG}{BF}$
$= \frac{2}{5}$ *



13(a) $\angle ABC = 53° - 35°$

$= 18°$

(b) $AC = \sqrt{253^2 + 523^2 - 2(253)(523)\cos 18°}$

$= 293.0$

≈ 293 m

(c) Shortest Distance

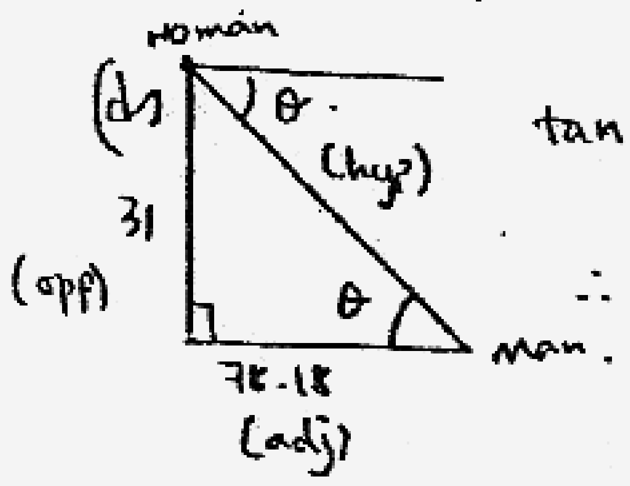
= perpendicular distance

$= 253 \sin 18°$

$= 78.18$

≈ 78.2 m

(d)



$\tan\theta = \frac{31}{78.18}$

$\therefore \theta = 21.62°$

$\approx 21.6°$

14. Refer to graph.

聖公會中學 Anglican High School

Name____________________ Index No. __________

Subject________________ Class ________ Date ________