

11/11/11
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MATHEMATICS YEAR 11 TASK 3 HALF YEARLY

2006
Term 2



TRINITY GRAMMAR SCHOOL
MATHEMATICS DEPARTMENT



YEAR 11 MATHEMATICS

ASSESSMENT TASK 3

(HALF YEARLY)

MONDAY, 1ST May, 2006.

TIME ALLOWED: $2\frac{1}{2}$ HOURS
(PLUS 5 MINUTES READING TIME)

ASSESSMENT WEIGHTING: 25%

Instructions:

- i) Do not open this paper until instructed.
- ii) There are 10 questions each worth 10 marks.
- iii) Marks for each part question are indicated on the paper.
- iv) In order to obtain all the marks for any question, full working must be shown.
- v) Board of studies approved calculators may be used.
- vi) Begin each question on a new page.
- vii) *Write your Name, Class and your Teacher's Name on each question.*

QUESTION 1) START A NEW PAGE	MARKS
a) Write 8132 000 000 in scientific notation.	1
b) Calculate correct to three significant figures; $\frac{4.321}{\sqrt[3]{8.79}}$	1
c) A car lost 22% of its value after 1 year. If it was worth \$30 225 after 1 year, what was the price when new?	2
d) Find the value of $\frac{A^2 B^3}{C^3}$ when $A = \frac{1}{2}$, $B = \frac{1}{3}$, $C = \frac{1}{4}$ Give your answer as a fraction in its simplest form.	2
e) Write 6 hours as a percentage of 3 days.	2
f) Simplify $5(k-3) - 8(k-9)$	2

QUESTION 2) START A NEW PAGE	MARKS
a) Subtract $6g - 7$ from $14g - 12$	1
b) Simplify $8a^2 b^5 \times 12ab^3$	1
c) The distance, d kilometres to the visible horizon from height h metres above sea level is given by the formula $d = 5\sqrt{\frac{h}{2}}$ Calculate the distance to the visible horizon from a height of 392 metres.	2
d) Simplify $\sqrt[3]{128} - \sqrt[3]{54}$ (Answer as a surd)	2
e) Expand $(3\sqrt{5} - \sqrt{2})^2$	2
f) Rationalise the denominator for $\frac{33}{2\sqrt{3}-1}$	2

QUESTION 3) START A NEW PAGE

MARKS

- a) Solve $3^{x+1} = \frac{1}{243}$ 2
- b) Solve $2(3a-1) = 5a+4$ 2
- c) Solve $|12-40k|=132$ 2
- d) Solve $k^2-12k-85=0$ 2
- e) Solve $\frac{2a}{3}-a > 4$ 2

QUESTION 4) START A NEW PAGE

MARKS

- a) Factorise completely: $121a - a^3$ 1
- b) Factorise: $k^2 - 6k + 9$ 1
- c) Given that $V = \frac{4\pi r^3}{3}$, make "r" the subject 2
- d) Simplify: $\frac{x+1}{4} + \frac{2x}{3}$ 2
- e) Factorise : $2a^3 - 16$ 2
- f) Simplify: $(a^2 - 1) \times \frac{1}{a+1}$ 2

QUESTION 7) START A NEW PAGE

MARKS

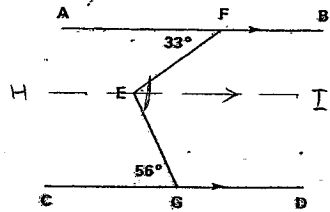
a) Calculate the number of sides in a regular polygon in which each interior angle is 168°

2

b) In the diagram below, AB is parallel to CD.

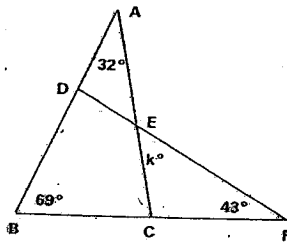
2

Calculate the size of $\angle FEG$ giving reasons.



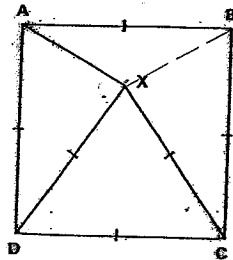
c) In the diagram below, calculate the value of "k" giving reasons.

2



d) ABCD is a square and CDX is an equilateral triangle. Find the sizes of $\angle AXB$ and $\angle AXC$ giving reasons.

4

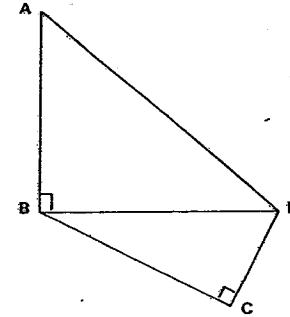


QUESTION 8) START A NEW PAGE

MARKS

a) In the diagram below, $CD = a$ units, BC and AB are both $2a$ units long. Prove $AD = 3a$ units. $\angle ABD = \angle BCD = 90^\circ$

2

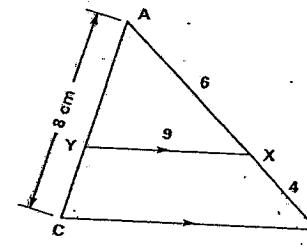


b) In the diagram below, XY is parallel to BC .

3

i) State why $\triangle AXY$ is similar to $\triangle ACB$.

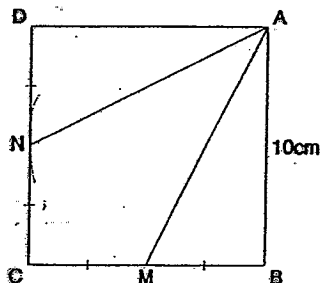
ii) Calculate lengths of AY and BC .



Q8 Continued

MARKS

- c) In the diagram below, ABCD is a square of side 10 cm.
M is the midpoint of BC and N is the midpoint of CD.



5

- Prove that $\triangle ABM \cong \triangle ADN$
- What type of quadrilateral is AMCN? Give reasons for your answer.
- Find the area of the quadrilateral AMCN.

QUESTION 9)

START A NEW PAGE

MARKS

- a) Sketch on the number plane, the region where the following inequalities are simultaneously true.

$$x^2 + y^2 \leq 9, \quad x \geq 0, \quad y > x.$$

3

- b) A function is defined by the rule:

$$f(x) = 5 \text{ for } x \leq -1$$

$$f(x) = 2 - 3x \text{ for } -1 < x \leq 0$$

$$f(x) = x^2 - 1 \text{ for } x > 0$$

Evaluate $f(-1) + f(0) + f(2)$

2

- c) Given that $\tan Y = \frac{2}{3}$ and that Y is an acute angle, calculate

the EXACT values of $\sin Y$ and $\cos Y$.

2

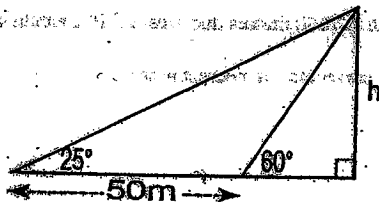
- d) The bearing of a point A from P is 210 degrees and the bearing of another point B from P is 242 degrees. Both A and B are due south of a point C which is 7600 metres due west of P. Calculate the distance from A to B, correct to the nearest metre.

3

QUESTION 10) START A NEW PAGE

MARKS

- a) Simplify. $\sqrt{1 + \tan^2 \theta} \cdot \sqrt{1 - \sin^2 \theta}$ 2
- b) Triangle ABC is an acute angled triangle with area of 70 cm^2 .
If $AB = 14 \text{ cm}$, $BC = 20 \text{ cm}$, Calculate the size of angle B. 2
- c) A hockey player is 7 metres from one goal post and 8.5 metres
from the other. The goal posts are 2 metres apart. Within what angle, to the
nearest degree, must she "shoot" for goal to have a chance of scoring? 2
- d) A man walking in a straight line towards the base of a tower 4
observes the angle of elevation of the top of the tower to be 25° .
After walking a further 50 metres towards the tower, the angle of elevation
of the top of the tower is then 60° . Calculate the height of the tower correct
to 1 decimal place. Copy the sketch below on to your paper to assist in
your working.



END OF EXAMINATION

(SA Copy)

YEAR 11 (UNIT) SOLUTIONS

11-MARKY #006 Term 2

YEAR 11 (UNIT) SOLUTIONS (2006)

a) 8.132×10^9 (1)

b) -2.09 (1)

c) New Price = $\frac{30225 \times 100}{78}$ (1) -WORKING
 $= \$38750$ (1)
 other methods possible

d) $\frac{\left(\frac{1}{2}\right)^2 + \left(\frac{1}{3}\right)^3}{\left(\frac{1}{4}\right)^3} = \frac{16}{27}$ (1)

e) $\frac{6}{72} \times 100 = 8.3\%$ (1)
 (or $8\frac{1}{3}\%$) (1)

f) $5k - 15 - 8k + 72$ (1)
 $= -3k + 57$ (1)

Total 10

SOLUTIONS

Q2) a) $14g - 12 - (9g - 7)$
 $= 8g - 5$ (1)

b) $96 a^3 b^8$ (1)

c) $d = 5 \sqrt{\frac{392}{a}}$ (1)

Dist = 70 km (1)

d) $\frac{\sqrt[3]{64} \times \sqrt[3]{a}}{4 \times \sqrt[3]{a}} - \frac{\sqrt[3]{27} \times \sqrt[3]{a}}{3 \times \sqrt[3]{a}}$
 $= \sqrt[3]{a}$ (1)

e) $(3\sqrt{5} - \sqrt{2})^2 = 45 - 6\sqrt{10} + 2$ (1)
 $= 47 - 6\sqrt{10}$ (1)

f) $\frac{33}{2\sqrt{3}-1} \cdot \frac{2\sqrt{3}+1}{2\sqrt{3}+1}$ (1)
 $= \frac{33(2\sqrt{3}+1)}{12-1}$
 $= 3(2\sqrt{3}+1)$ (1)

Total 10

Q3) a) $3^{x+1} = 3^{-5}$ (1)
 $x = -6$ (1)

b) $6a - 2 = 5a + 4$ (1)
 $a = 6$ (1)

c) $12 - 40k = 132$ OR $12 - 40k = -132$
 $-40k = 120$ (1) $-40k = -144$
 $k = -3$ (1) $k = 3\frac{9}{5}$ (OR 3.6) (1)

d) $k^2 - 12k - 85 = 0$
 $(k+5)(k-17) = 0$ (1)
 $k = -5, k = 17$ (1)

e) $\frac{2a}{3} - a > 4$

$2a - 3a > 12$ (1)

$-a > 12$

$a < -12$ (1)

Total 10

④) a) $12a - a^3$
 $= a(12 - a^2)$
 $= a(11-a)(11+a)$ ①

b) $k^2 - 6k + 9$
 $= (k-3)^2$ ①

c) $V = \frac{4\pi r^3}{3}$
 $\frac{3V}{4\pi} = r^3$ ①
 $r = \sqrt[3]{\frac{3V}{4\pi}}$ ①

d) $\frac{x+1}{4} + \frac{2x}{3}$
 $\frac{3x+3 + 8x}{12}$ ①
 $= \frac{11x+3}{12}$ ①

e) $2a^3 - 16 = 2(a^3 - 8)$ ①
 $2(a-2)(a^2+2a+4)$ ①

f) $(a^2-1) \times \frac{1}{a+1}$
 $\frac{(a-1)(a+1)}{a+1} = a-1$ ①
 Total 10

⑤) a) $-13 \leq 2x+1 \leq 7$

$-14 \leq 2x \leq 6$

$-7 \leq x \leq 3$ ①

b) $2x+y=4$ ①
 $5x+2y=9$ ②

OF COURSE
CAN USE

ELIMINATION

From ① $y = 4-2x$

Sub ② $5x + 2(4-2x) = 9$ ①

$5x + 8 - 4x = 9$

$x = 1$

$y = 2$

①' ① OR (1, 2)

c) $y = x^2 - 4x$
 $y = 3x - 12$

$x^2 - 4x = 3x - 12$

$x^2 - 7x + 12 = 0$ ①

$(x-4)(x-3) = 0$

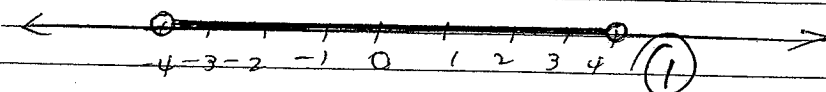
$x = 4, x = 3$ ①

$x = 4, y = 0$ and $x = 3, y = -3$
 ① ①

d) $|9a| < 36$

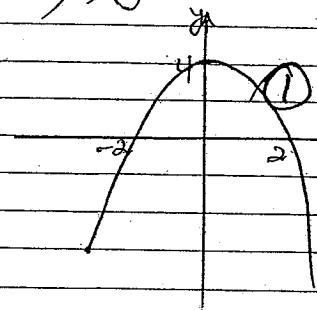
$-36 < 9a < 36$

$-4 < a < 4$ ①



Total 10

Q6) a) $y = 4 - x^2$



FOR EACH SKETCH ①

DOM & RANGE ①

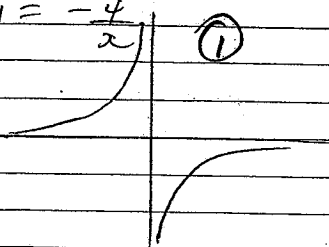
Subtract $\frac{1}{2}$ MARK for EACH EA
DOM & RANGE

① DOMAIN: $x = \text{All Reals}$ Round TO

① RANGE: $y \leq 4$ WHOLE

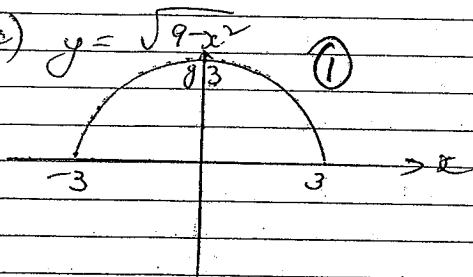
NUMBER FOR FULL QUESTION

b) $y = -\frac{4}{x}$ ①



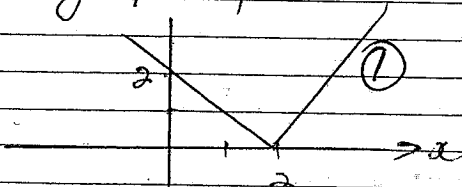
DOMAIN: $x = \text{All reals } x \neq 0$
RANGE: $y = \text{All reals } y \neq 0$

c) $y = \sqrt{9 - x^2}$ ①



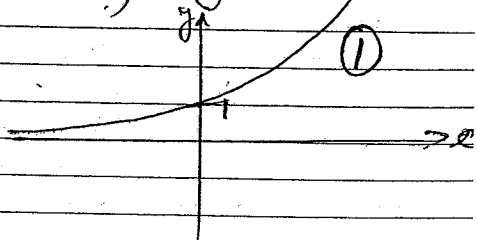
DOMAIN: $-3 \leq x \leq 3$
RANGE: $0 \leq y \leq 3$ ①

d) $y = |x - 2|$ ①



DOMAIN: $x = \text{All reals}$
RANGE: $y \geq 0$ ①

e) $y = 2^x$ ①

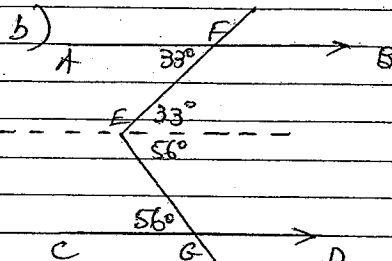


DOMAIN: $x = \text{All reals}$
RANGE: $y > 0$ ①

TOTAL 10

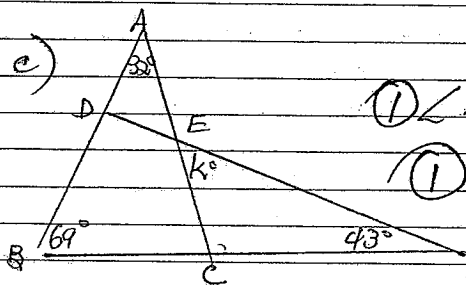
Q7) a) Each exterior = 12° ①

NO SIDES = $360 \div 12$
 $= 30$ ①



$\angle FEC = 33 + 56$
 $= 89^\circ$ ①

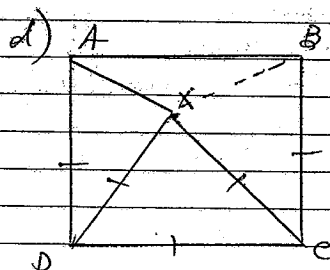
Alternate Angles $AB \parallel CD$ ①



① $\angle ACF = 101^\circ$ (Exterior Angle of Δ)

① $k = 35^\circ$
Angle Sum of Δ

(Other methods possible)



$\angle AOX = 30^\circ$ (Right Angle $- 60^\circ$) ①

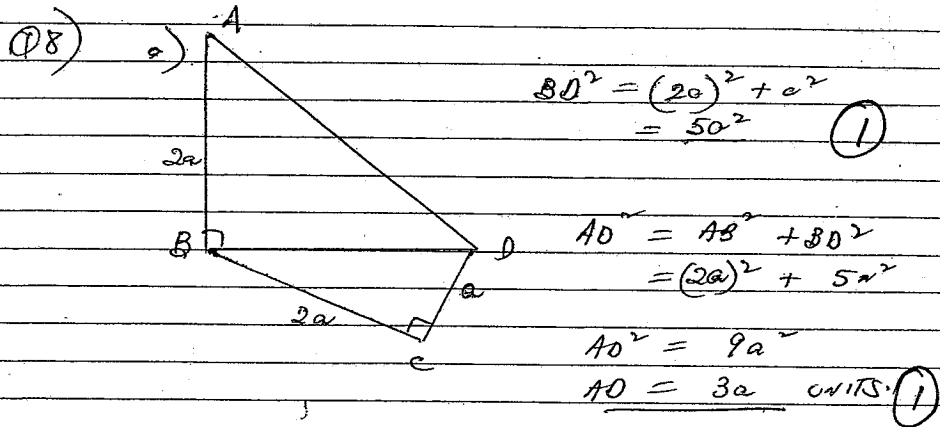
$\angle AXO = 75^\circ$ (Base \angle 's Isos Δ) ①

Also $\angle BXC = 75^\circ$ (" " " ") ①

Then $\angle AXB = 360 - 75 - 75 - 60$
 $= 150^\circ$ ①

$\angle AXC = 75 + 60$ (Shown previously)
 $= 135^\circ$ ①

Total 10



b) ΔAXX SIMILAR TO ΔACB
 because $XY \parallel BC$
 Corres \therefore ~~Alt~~ angles are equal (1)
 $\angle AXY = \angle ACB$
 $\angle AXY = \angle ABC$

$$\frac{AY}{8} = \frac{6}{10} \quad \frac{9}{BC} = \frac{6}{10}$$

$$AY = 4.8 \quad (1) \quad BC = 15 \quad (1)$$

c) In ΔABM and ΔADN

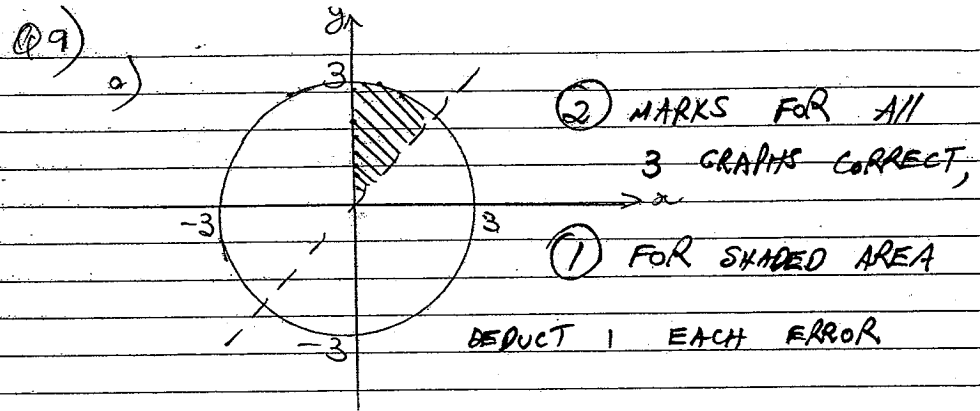
- i) $AB = AD$ (Sides of Square)
- ii) $\angle ABM = \angle ADN$ (Right angles)
- iii) $BM = DN$ ($\frac{1}{2}$ of Side of Square)

$\therefore \Delta ABM \cong \Delta ADN$ (SAS) (2)

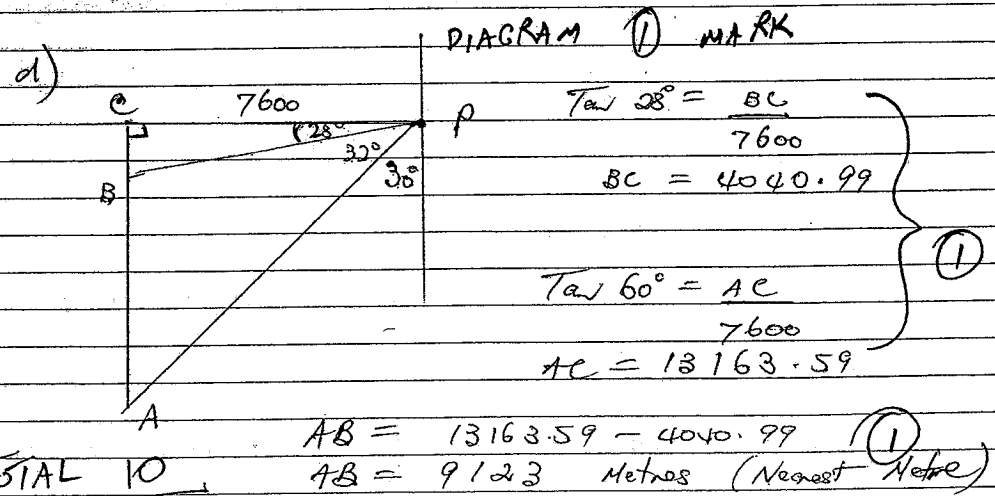
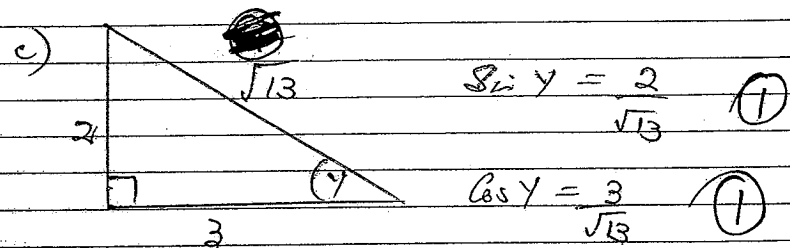
ii) $AMCN$ is a kite (1) REASON - $AM = AN$
 and $BM = MC = CN$
 Corres Sides of Congruent Δ 's (1)

iii) Area $AMCN = 10^2 - 2 \times \frac{1}{2} \times 10 \times 5 = 50 \text{ cm}^2 \quad (1)$

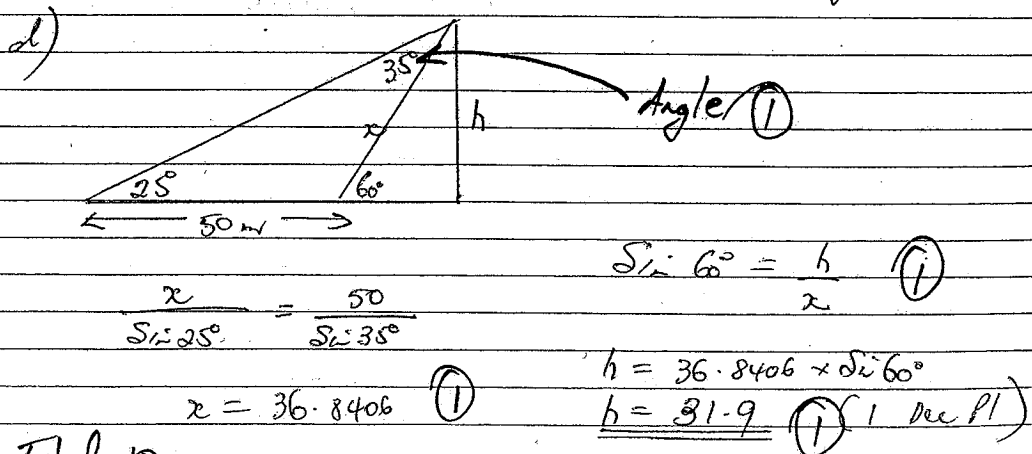
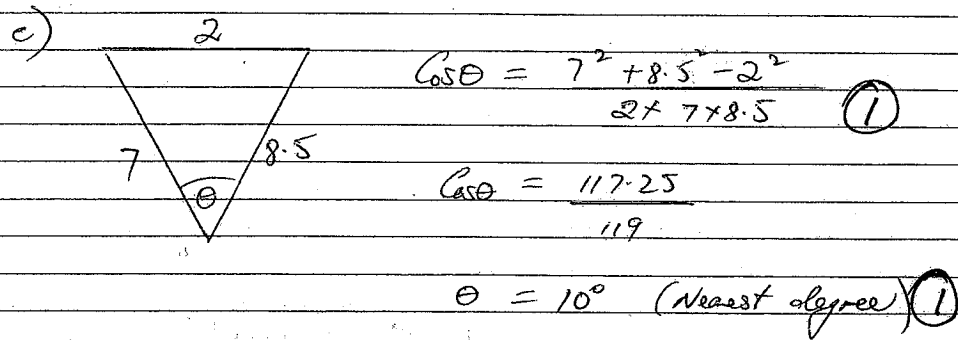
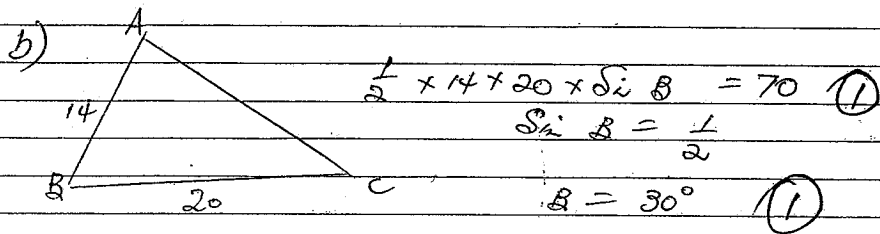
Total 10



b) $f(-1) + f(0) + f(2)$
 $= 5 + (2-0) + (2^2-1) \quad (1)$
 $= 5 + 2 + 3$
 $= 10 \quad (1)$



Q10) a) $\sqrt{1+\tan^2 \theta} \cdot \sqrt{1-\sin^2 \theta}$
 $= \sec \theta \cdot \cos \theta$ (1)
 $= \frac{1}{\cos \theta} \times \cos \theta$
 $= 1$ (1)



Total 10