SYDNEY BOYS HIGH SCHOOL
MOORE PARK, SURRY HILLS

Year 9

Yearly Examination 2007

Mathematics

General Instructions

- Working time – 90 minutes
- Write using black or blue pen.
- Approved calculators may be used.
- All necessary working MUST be shown in every question if full marks are to be awarded.
- Marks may not be awarded for untidy or badly arranged work.
- If more space is required, clearly write the number of the QUESTION on one of the back pages and answer it there. Indicate that you have done so.
- Clearly indicate your class by placing an X, next to your class

Examiner: *C. Kourtesis*

NAME:

Class	Teacher	
9 A	Mr Fuller	
9 B	Mr McQuillan	
9 C	Ms Evans	
9 D	Ms Ward	
9 E	Ms Nesbitt	
9 F	Mr Boros	

Section	Mark
A	/17
B	/17
C	/18
D	/15
E	/16
F	/17
Total	/100

SECTION A (18 marks) **ANSWERS** marks

1. Express 0.65 as a fraction in simplest form.

2. Find 8% of $2500.

3. Simplify i) $3a + 5b + 10a$

   ii) $4(2a + 3b)$

   iii) $2^4 \times 2^{-2}$

4. Write 94.735 correct to one decimal place.

5. Divide $180 in the ratio 7:2 .

6. Factorise $3a + 6ab$.

7. Write in scientific notation

   i) 7 035 469

   ii) 0.00014

8. Calculate k if $\sqrt{2000} = k\sqrt{5}$.

SECTION A **ANSWERS** marks

9. Evaluate $\left(\frac{1}{9}\right)^{1/2}$

---

10. Simplify

i) $\frac{2a}{3} \times \frac{6}{a^2}$

ii) $\frac{x}{5} + \frac{2x}{9}$

---

11. If $a = 4$, $b = -3$ evaluate

i) ab^2

ii) $(a - b)(a + b)$

---

12. Solve

$5 + 3x = x - 13$

SECTION B **ANSWERS** marks

1. Expand and simplify the following:

i) $(x + 5)(x - 10)$

ii) $(4a - 1)(4a + 1)$

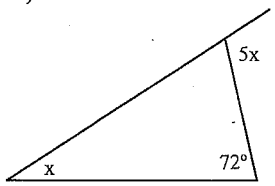
---

2. Find the size of each interior angle of a regular octagon.

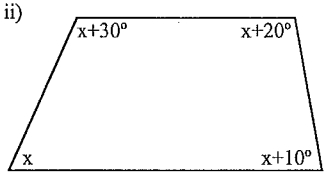
---

3. Find the value of x in the following:

i)



ii)



SECTION B **ANSWERS** marks

4. Name all quadrilaterals
whose diagonals are perpendicular.

5. Bob earns a salary of $87 500 p.a.
What is his fortnightly income?

6. The retail price of an LCD TV was $7000.
What was the original price
before the GSTof 10% was added?

7. Simplify $\frac{4a-12}{6}$.

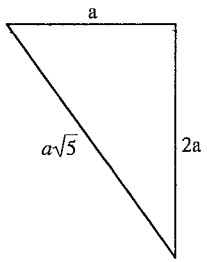
8. Find the area of a square
with sides $(2x-3y)$ cm.

9. i) Solve the inequality $-4x > 16$.

ii) Graph the solution on a number line.

SECTION B **ANSWERS** marks

10. Is the triangle right-angled?
Give a reason for your answer.

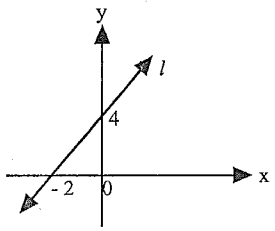


11. Write as algebraic expressions:
i) the length of a rectangle whose
perimeter is 18 cm and width b cm.

ii) the square root of the sum
of the squares of a and b.

SECTION C **ANSWERS** marks

1.



The equation of the straight line l is $y = mx + b$. Write down the values of m and b.

---

2. Express $L = k - mn$ with n as the subject.

---

3. Solve the equations:

i) $\frac{3}{2a} = 12$

ii) $\frac{n}{3} + \frac{2n+1}{4} = 1$

---

4. Factorise the following:

i) $x^2 - 25$

ii) $a^2 - 3a - 10$

iii) $x^3 + x^2 + 2x + 2$

SECTION C **ANSWERS** marks

5. Given the points A (4, - 8) and B (2, 4) find the:

i) length of the interval AB

ii) gradient of the line AB

iii) midpoint of the interval AB

---

6. Find the linear relationship between x and y from the table:

x	-2	-1	0	1
y	-5	-3	-1	1

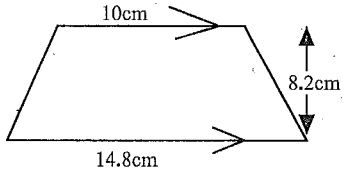
---

7. Express with a rational denominator

$$\frac{\sqrt{3}}{\sqrt{5}+2}$$

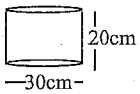
---

8. Find the area of the trapezium



SECTION D **ANSWERS** marks

1. For the cylinder



find the

i) volume in terms of π

ii) curved surface area
in terms of π

iii) capacity in litres
(correct to nearest litre)

---

2. Solve simultaneously using the substitution method:

$5x - 3y = 10$
$x + y = 9$

---

3. Express $a = \dfrac{b+1}{3b-2}$
with b as the subject.

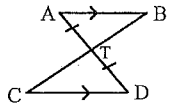
---

4. Simplify: $\dfrac{2-a}{a^2-4}$

SECTION D **ANSWERS** marks

5. At a supermarket brand A of a bottle of sauce contains 750ml and costs $1.14, while brand B contains 600ml and costs 90c.
Which is the better buy? Explain.

6.



The straight lines AD and BC intersect at T. Explain why AB = CD.

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7. An irrigation channel is 2m wide and 0.5m deep.
Water flows along it at 2km/h.
How many kilolitres are delivered in 8 hours?

SECTION E **ANSWERS** marks

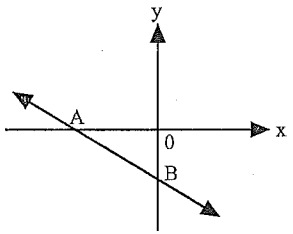
1. Factorise
$3m^2 - 11m + 6$

2. Find $\sqrt{a^9 b^{16}}$

3. Solve the inequality

$$\frac{3a}{4} - \frac{1-a}{3} \leq 2$$

4. The diagram below shows the graph of the straight line $3x + 4y + 7 = 0$.



Find the area of triangle A0B.

5. The probability of drawing two hearts from a standard pack of cards is $\frac{3}{51}$.
What is the probability that two cards drawn are not both hearts?

SECTION E **ANSWERS** marks

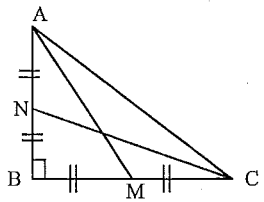
6. Find the equation of the line passing through the points A (-1,4) and B (6,10).

7. A boy cycles from his house at a constant speed of 20km/h, to his friend's house d km away. He then cycles back to his house at a constant speed of 25km/h.

i) Show that the expression for time T, taken for the whole trip, is given by $T = \frac{9d}{100}$.

ii) If the whole trip takes 54 minutes, how far is it to his friend's house?

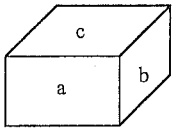
8.



In the above diagram
AN=BN=BM=MC .
If AM=CN=$\sqrt{5}$ cm , find the length of AC.

SECTION F **ANSWERS** marks

1.



The rectangular prism has adjacent faces of area a, b and c units^2. Find an expression for the volume of the prism in terms of a, b and c.

2. Sketch the region that is common to the inequalities $y \geq 0$, $x \leq 5$ and $x - 2y - 4 \geq 0$.

SECTION F **ANSWERS** marks

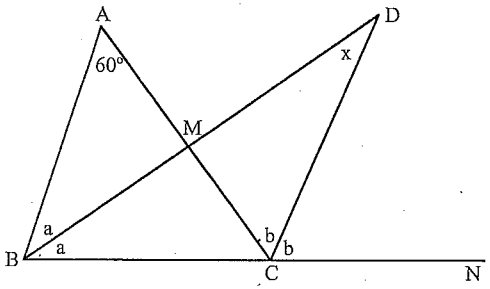
3. The straight line $ax + by + 10 = 0$ passes through the point (5, -2) and is also perpendicular to the straight line $3x - 4y = 12$. Find the values of a and b.

4. Factorise $xy(m^2 + n^2) + mn(x^2 + y^2)$.

5. Simplify $\dfrac{1}{1+\sqrt{1+a}} + \dfrac{1}{1-\sqrt{1-a}}$

SECTION F **ANSWERS** marks

6.



From the diagram above find the value of:

i) b - a (giving reasons)

ii) x (giving reasons)

THIS IS THE END OF THE EXAM

SBHS - Yr 9 - Yrly 2007 Solutions

SECTION A (17 marks) — **ANSWERS** — marks

1. Express 0.65 as a fraction in simplest form. $\frac{65}{100} = \frac{13}{20}$

2. Find 8% of $2500. $\frac{8}{100} \times 2500 = \$200$

3. Simplify i) $3a + 5b + 10a = 13a + 5b$

ii) $4(2a + 3b)$ or $8a + 12b$

iii) $2^4 \times 2^{-2} = 2^2$

4. Write 94.735 correct to one decimal place.

94.7

5. Divide $180 in the ratio 7:2. $140 : $40 ½ each

6. Factorise $3a + 6ab$. $3a(1 + 2b)$

7. Write in scientific notation

i) 7 035 469 7.035469×10^6

ii) 0.00014 1.4×10^{-4}

8. Calculate k if $\sqrt{2000} = k\sqrt{5}$. $k\sqrt{400 \times 5}$

$k = 20$

SECTION A — **ANSWERS** — marks

9. Evaluate $\left(\frac{1}{9}\right)^{\frac{1}{2}} = \frac{1}{3}$

10. Simplify ✓

i) $\frac{2a}{3} \times \frac{6}{a^2} = \frac{4}{a}$

1 a

ii) $\frac{x}{5} + \frac{2x}{9} = \frac{9x}{45} + \frac{10x}{45}$

$= \frac{19x}{45}$

11. If $a = 4$, $b = -3$ evaluate

i) $ab^2 = 4 \times 9$

$= 36$

ii) $(a - b)(a + b)$ $(4 + 3)(4 - 3)$

$= 7 \times 1$

$= 7$

12. Solve

$5 + 3x = x - 13$

$2x = -18$

$x = -9$

SECTION B (17 marks) **ANSWERS** marks

1. Expand and simplify the following: 1

i) $(x+5)(x-10)$

$x^2 - 10x + 5x - 50$

$x^2 - 5x - 50$

ii) $(4a-1)(4a+1)$ 1

$16a^2 + 4a - 4a - 1$

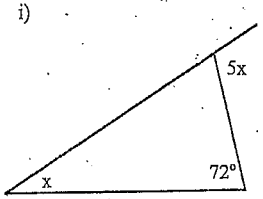
$16a^2 - 1$

2. Find the size of each interior angle of a regular octagon. 1

$\frac{6 \times 180}{8} = 135°$

3. Find the value of x in the following: 1

i)

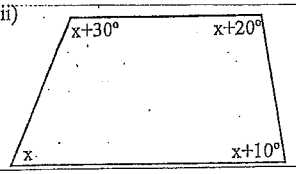


$5x = x + 72$

$4x = 72$

$x = 18°$

ii) 2



$x+30+x+20+x+x+10 = 360°$

$4x + 60 = 360$

$4x = 300$

$x = 75$

SECTION B **ANSWERS** marks

4. Name all quadrilaterals whose diagonals are perpendicular. 1½

RHOMBUS

SQUARE

KITE

5. Bob earns a salary of $87 500 p.a. What is his fornightly income? 1

$87\,500 \div 26$

$3365.38 (nearest cent)

6. The retail price of an LCD TV was $7000. What was the original price before the GSTof 10% was added? 1

$\frac{7000}{110} \times 100$

$6363.64 (nearest cent)

7. Simplify $\frac{4a-12}{6}$. 1

$\frac{2a-6}{3}$

8. Find the area of a square with sides $(2x-3y)$ cm. 1

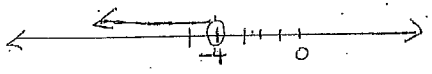
$4x^2 - 12xy + 9y^2$

9. i) Solve the inequality $-4x > 16$. 1

$-4x > 16$

$x < -4$

ii) Graph the solution on a number line. 1



SECTION B

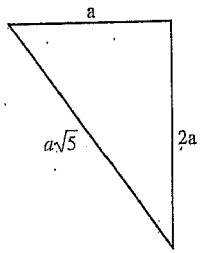
ANSWERS

marks

10. Is the triangle right-angled?
Give a reason for your answer.

Pythagoras' Theorem

$\frac{1}{2}$



$\sqrt{a^2+4a^2} = \sqrt{5a^2}$

$= a\sqrt{5}$

yes

---

11. Write as algebraic expressions:

i) the length of a rectangle whose perimeter is 18 cm and width b cm.

1

$2l + 2b = 18$

$l + b = 9$

$l = 9 - b$

ii) the square root of the sum of the squares of a and b.

1

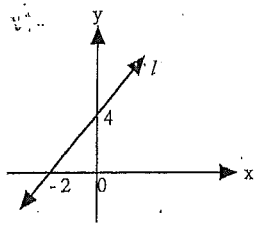
$\sqrt{a^2+b^2}$

SECTION C (18 marks)

ANSWERS

marks

1.



$m = 2.$

$b = 4.$

The equation of the straight line l is $y = mx + b$. Write down the values of m and b.

---

2. Express $L = k - mn$ with n as the subject.

$L = k - mn.$

$L - k = -mn.$

$mn = k - L.$

$n = \frac{k-L}{m}.$

---

3. Solve the equations:

i) $\frac{3}{2a} = 12$

$3 = 24a \quad a = \frac{1}{8}.$

ii) $\frac{n}{3} + \frac{2n+1}{4} = 1$

$4n + 6n + 3 = 12.$

$10n = 9$

$n = 9/10.$

---

4. Factorise the following:

i) $x^2 - 25 = (x+5)(x-5)$

ii) ~~$a^2 - 3a - 10$~~ $= (x+2)(x-5)$

iii) $x^3 + x^2 + 2x + 2 = x^2(x+1) + 2(x+1)$

$= (x^2+2)(x+1).$

SECTION C ANSWERS marks

5. Given the points A (4, - 8) and B (2, 4) find the:

i) length of the interval AB

$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2} = \sqrt{(4-2)^2+(-8-4)^2} = \sqrt{148}$.

ii) gradient of the line AB

$m = \frac{y_2-y_1}{x_2-x_1} = \frac{-12}{2} = -6$

iii) midpoint of the interval AB

$\left(\frac{x_2+x_1}{2}, \frac{y_2+y_1}{2}\right) = (3, -2)$.

6. Find the linear relationship between x and y from the table:

x	-2	-1	0	1
y	-5	-3	-1	1

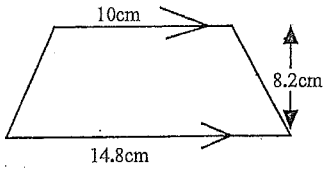
$y = 2x - 1$.

7. Express with a rational denominator

$\frac{\sqrt{3}}{\sqrt{5}+6} \times \frac{\sqrt{5}-6}{\sqrt{5}-6} = \frac{\sqrt{15}-6\sqrt{3}}{5-36} = \frac{6\sqrt{3}-\sqrt{15}}{31}$.

or $\frac{\sqrt{15}-6\sqrt{3}}{-31}$.

8. Find the area of the trapezium



$A = \frac{h}{2}(a+b)$

$= \frac{8.2}{2}(10+14.8)$

$= 101.68 cm^2$.

SECTION D (15 marks) ANSWERS marks

1. For the cylinder

find the

i) volume in terms of π

$V = \pi r^2 h$

ii) curved surface area in terms of π

$C = \pi d$

$= 30\pi$

iii) capacity in litres (correct to nearest litre)

i) $V = \pi \times 15^2 \times 20$ ½ for no π

$= 4500\pi cm^3$ - no marks for decimal / no working. 1

ii) $SA = 30\pi \times 20$ same as i)

$= 600\pi cm^2$ 1

½ for 1050π

iii) Capacity is $1m^3 = 1000L$

$\therefore V = 0.04137166 m^3$

$\therefore$ Capacity $= 14.14716694$ 1

$= 14$ litres

-½ for incorrect rounding.

2. Solve simultaneously using the substitution method:

$5x - 3y = 10$ ①

$x + y = 9$ ②

from ② $x = 9 - y$

sub into ①

$5(9-y) - 3y = 10$

$45 - 5y - 3y = 10$

$35 = 8y$

$\therefore y = \frac{35}{8}$ ①

sub into ②

$x + \frac{35}{8} = 9$ 2

$x = \frac{37}{8}$ ①

3. Express $a = \frac{b+1}{3b-2}$ with b as the subject.

$a(3b-2) = b+1$

$3ab - 2a = b + 1$

$3ab - b = 2a + 1$

$b(3a-1) = 2a+1$

$b = \frac{2a+1}{3a-1}$ OR $\frac{-2a-1}{1-3a}$ 2

-1 for 1st error

-½ ✓ each extra error.

4. Simplify: $\frac{2-a}{a^2-4}$

$\frac{2-a}{(a+2)(a-2)}$ ①

$= \frac{(2-a)}{(a+2)(a-2)}$

$= \frac{-1}{a+2}$ ①

$\frac{1}{a-2} = 0$ 2

SECTION D | **ANSWERS** | marks

5. At a supermarket brand A of a bottle of sauce contains 750ml and costs $1.14, while brand B contains 600ml and costs 90c.
Which is the better buy? Give a reason.

A = 15.2¢ per 100ml

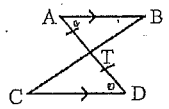
B = 15¢ per 100ml

∴ B is a better buy by 0.2¢ per 100ml

2

½ for B only

6.



The straight lines AD and BC intersect at T. Explain why AB = CD.

AT = TD - given

∠BAT = ∠CDT (alt ∠'s on ∥ lines)

∠BTA = ∠CTD (vert opposite)

∴ △ABT ≡ △CDT (AAS)

∴ AB = CD corresponding sides in congruent △'s)

2

① for = △ test

① for stating why AB = CD.

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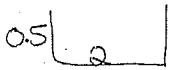
7. An irrigation channel is 2m wide and 0.5m deep. Water flows along it at 2km/h. How many kilolitres are delivered in 8 hours?



$2 \times 0.5 \times 2000 = 2000 m^3$ ①

$1m^3 = 1kL$.

∴ 1 hour = 2000kL

∴ 8 hours = 16 000kL ①

2

½ only for 16 with working

0 for 16 no working

SECTION E | **ANSWERS** | marks

1. Factorise $3m^2 - 11m + 6$

$\frac{(3m-2)(3m-9)}{3} = (3m-2)(m-3)$

---

2. Find $\sqrt{a^9 b^{16}}$

$a^{\frac{9}{2}} b^8$

---

3. Solve the inequality $\frac{3a}{4} - \frac{1-a}{3} \leq 2$

$9a - 4 + 4a \leq 24$.

$13a \leq 28$.

$a \leq \frac{28}{13}$

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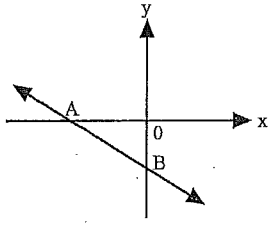
4. The diagram below shows the graph of the straight line $3x + 4y + 7 = 0$.



Find the area of triangle A0B.

x-int $3x + 7 = 0$ y-int $4y + 7 = 0$

$x = -\frac{7}{3}$. $y = -\frac{7}{4}$

Area $= \frac{1}{2} \times \frac{7}{3} \times \frac{7}{4}$

$= \frac{49}{24}$.

---

5. The probability of drawing two hearts from a standard pack of cards is $\frac{3}{51}$.
What is the probability that two cards drawn are not both hearts?

$1 - \frac{3}{51} = \frac{16}{17}$.

SECTION E ANSWERS marks

6. Find the equation of the line passing through the points A (-1,4) and B (6,10).

$m = \frac{10-4}{6+1}$

$= \frac{6}{7}$

$y - 4 = \frac{6}{7}(x+1)$

$7y - 28 = 6x + 6.$

$6x - 7y + 34 = 0.$

---

7. A boy cycles from his house at a constant speed of 20km/h, to his friend's house d km away. He then cycles back to his house at a constant speed of 25km/h.

i) Show that the expression for time T, taken for the whole trip, is given by $T = \frac{9d}{100}$.

$S = \frac{D}{T}$

$T = \frac{D}{S}$

$\frac{d}{20} + \frac{d}{25} = \frac{5d}{100} + \frac{4d}{100}$

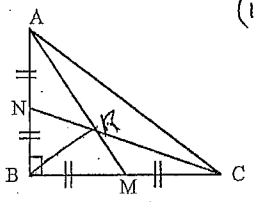
$= \frac{9d}{100}.$

ii) If the whole trip takes 54 minutes, how far is it to his friend's house?

$\frac{9d}{100} = \frac{9}{10}$ $9d = 90$

$d = 10$km.

8.



In the above diagram AN=BN=BM=MC. If AM=CN=$\sqrt{5}$ cm, find

(i) the length of AC.

(ii) area of triangle RMC

(i') Let $NB = a$.

So $\sqrt{5}^2 = a^2 + (2a)^2$

$5 = 5a^2$

$a = 1$

$AC^2 = 2^2 + 2^2$

$= 8$

$AC = 2\sqrt{2}.$

area ΔARN = area ΔNRB = area ΔRMB = area ΔRMC.

Let area $\Delta RMC = X$.

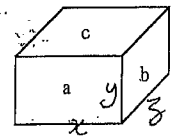
area $\Delta AMB = 3X$

$1 = 3X$

$X = \frac{1}{3}$ cm^2.

SECTION F (17 marks) ANSWERS marks

1.



The rectangular prism has adjacent faces of area a, b and c units^2. Find an expression for the volume of the prism in terms of a, b and c.

$a = xy$

$b = yz$

$c = xz$

$abc = x^2y^2z^2$

$xyz = \sqrt{abc}$

$V = xyz$

$V = \sqrt{abc}$

(2)

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2. Sketch the region that is common to the inequalities $y \geq 0$, $x \leq 5$ and $x - 2y - 4 \geq 0$.

$x - 2y - 4 = 0$

when $x = 0$.

$2y = -4$

$y = -2$

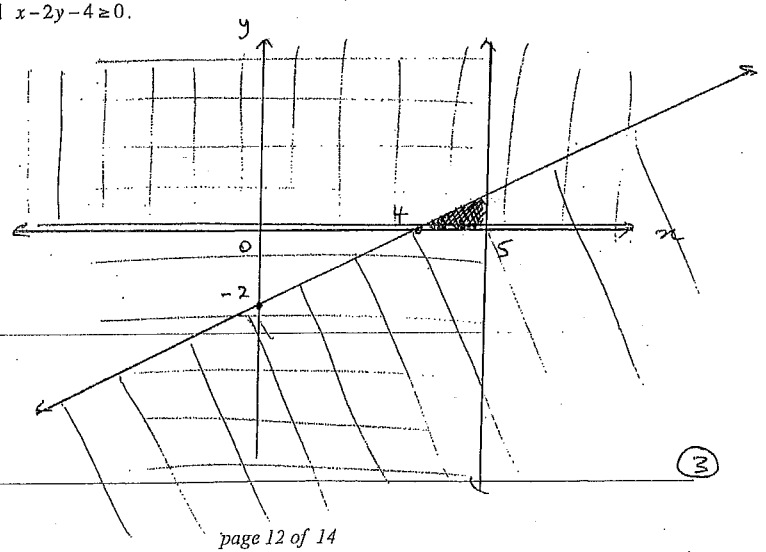
when $y = 0$

$x = 4$

$x - 2y - 4 \geqslant 0$

test (0,0)

$-4 \geqslant 0$ ✗



(3)

SECTION F **ANSWERS** marks

3. The straight line $ax + by + 10 = 0$
passes through the point (5, -2)
and is also perpendicular to the straight line $3x - 4y = 12$.
Find the values of a and b.

$4y = 3x - 12$

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

$m_1 = \frac{3}{4}$

$m_2 = -\frac{4}{3}$

$by = -ax - 10$

$y = -\frac{a}{b}x - \frac{10}{b}$

$-\frac{a}{b} = -\frac{4}{3}$

$a = \frac{4}{3}b$ ——①

sub (5,-2) into $ax + by + 10 = 0$

$5a - 2b + 10 = 0$ ——②

sub ① into ②

$5(\frac{4}{3}b) - 2b + 10 = 0$

$\frac{20}{3}b - 2b = -10$

$20b - 6b = -30$

$14b = -30$

$b = -\frac{15}{7}$

sub into ①

$a = \frac{4}{3}(-\frac{15}{7})$

$a = \frac{-20}{7}$

(3)

4. Factorise $xy(m^2 + n^2) + mn(x^2 + y^2)$.

$= xym^2 + xyn^2 + mnx^2 + mny^2$

$= xym^2 + mnx^2 + xyn^2 + mny^2$

$= mx(my + nx) + ny(nx + my)$

$= (my + nx)(mx + ny)$

(2)

5. Simplify $\frac{1}{1+\sqrt{1+a}} + \frac{1}{1-\sqrt{1-a}}$

$= \frac{1}{1+\sqrt{1+a}} \times \frac{1-\sqrt{1+a}}{1-\sqrt{1+a}} + \frac{1}{1-\sqrt{1-a}} \times \frac{1+\sqrt{1-a}}{1+\sqrt{1-a}}$

$= \frac{1-\sqrt{1+a}}{1-(1+a)} + \frac{1+\sqrt{1-a}}{1-(1-a)}$

$= \frac{1-\sqrt{1+a}}{-a} + \frac{1+\sqrt{1-a}}{a}$

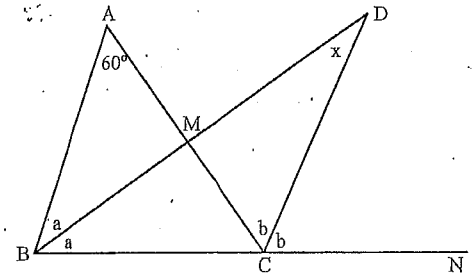
$= \frac{\sqrt{1+a}-1}{a} + \frac{1+\sqrt{1-a}}{a}$

$= \frac{\sqrt{1+a}+\sqrt{1-a}}{a}$

(2)

SECTION F **ANSWERS** marks

6.



From the diagram above find the value of:

i) b - a (giving reasons)

$2b = 60 + 2a$ (ext. ∠ of △)

$2b - 2a = 60$

$2(b - a) = 60$

$b - a = 30°$

(2)

ii) x (giving reasons)

$b = x + a$ (ext. ∠ of △)

$x = b - a$

$x = 30°$

(1)

7. Simplify $\frac{25^{2n+1} \times 5^{6-n}}{125^{1-n} \times (5^n)^3}$

$= \frac{(5^2)^{2n+1} \times 5^{6-n}}{(5^3)^{1-n} \times 5^{3n}}$

$= \frac{5^{4n+2} \times 5^{6-n}}{5^{3-3n} \times 5^{3n}}$

$= \frac{5^{3n+8}}{5^3}$

$= 5^{3n+5}$

(2)

THIS IS THE END OF THE EXAM