



**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 $\left(\frac{1}{9}\right)^{\frac{1}{2}}$

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

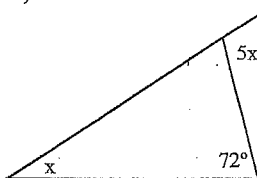
1. Expand and simplify the following:

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

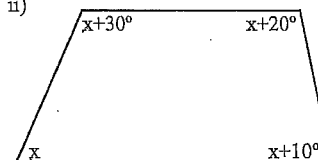
ii) $(4a-1)(4a+1)$

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

3. Find the value of x in the following:



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 GST of 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 $-4x > 16$.

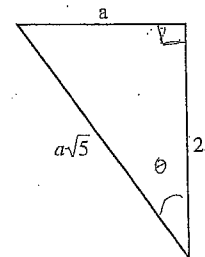
- ii) Graph the solution on a number line.

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.

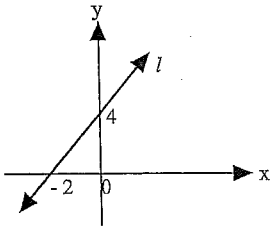
- ii) the square root of the sum of the squares of a and b .

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

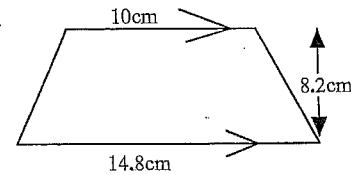
6. Find the linear relationship between x and y from the table:

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

7. Express with a rational denominator

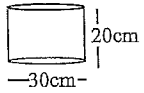
$$\frac{\sqrt{3}}{\sqrt{5}+2}$$

8. Find the area of the trapezium



SECTION D

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

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

ANSWERS

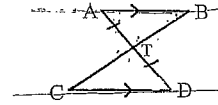
marks

SECTION D

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
 $AB = CD$.

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?

ANSWERS

marks

SECTION E

ANSWERS

marks

1. Factorise

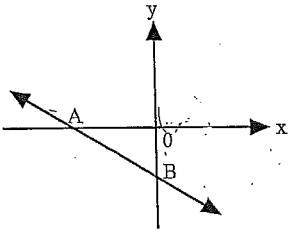
$$3m^2 - 11m + 6$$

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 AOB.

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).

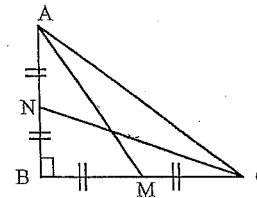
7. A boy cycles from his house at a constant speed of 20km/h, to his friend's house d km away. He then cycles back to his house at a constant speed of 25km/h.

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.

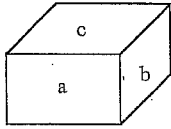


In the above diagram $AN = BN = BM = MC$.

If $AM = CN = \sqrt{5}$ cm, find the length of AC.

SECTION F

1.



The rectangular prism has adjacent faces of area a , b and c units². Find an expression for the volume of the prism in terms of a , b and c .

ANSWERS

marks

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

SECTION F

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 .

ANSWERS

marks

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

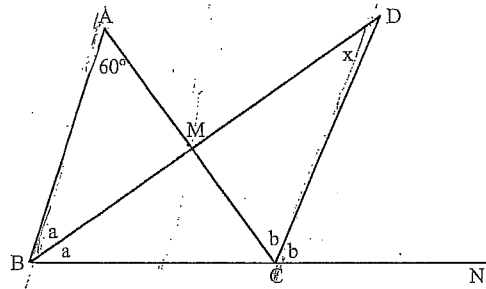
-
5. Simplify $\frac{1}{1 + \sqrt{1+a}} + \frac{1}{1 - \sqrt{1-a}}$

SECTION E

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

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) $4(2a + 3b) = 8a + 12b$

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 $\frac{1}{2}$ 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 $\sqrt{2000} = k\sqrt{5}$.

$\sqrt{400 \times 5}$
 $k = 20$

SECTION A

ANSWERS

marks

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

10. Simplify

i) $\frac{2a}{3} \times \frac{6}{a} = \frac{4}{1}$

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:

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

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

$$x^2 - 5x - 50$$

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

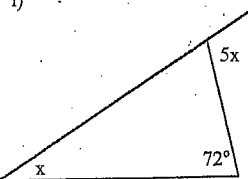
$$16a^2 + 4a - 4a - 1$$

$$16a^2 - 1$$

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

$$\frac{6 \times 180}{8} = 135^\circ$$

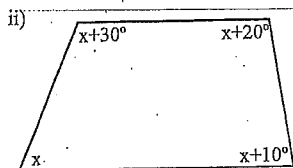
3. Find the value of x in the following:



$$5x = x + 72$$

$$4x = 72$$

$$x = 18^\circ$$



$$x+30+x+20+x+x+10 = 360$$

$$4x + 60 = 360$$

$$4x = 300$$

$$x = 75$$

SECTION B

ANSWERS

marks

4. Name all quadrilaterals whose diagonals are perpendicular.

RHOMBUS

SQUARE

KITE

1/2

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

$$87500 \div 26$$

$$\$3365.38$$

nearest cent

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

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

$$\$6363.64$$

nearest cent

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

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

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

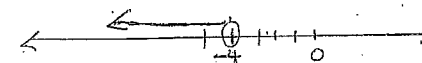
$$4x^2 - 12xy + 9y^2$$

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

$$-4x > 16$$

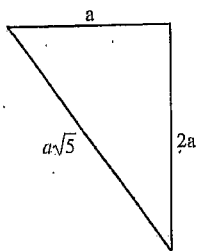
$$x < -4$$

ii) Graph the solution on a number line.



SECTION B

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



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

yes

Pythagoras Theorem

ANSWERS

marks

$\frac{1}{2}$

11. Write as algebraic expressions:

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

$$\begin{aligned} 2l + 2b &= 18 \\ l + b &= 9 \\ l &= 9 - b \end{aligned}$$

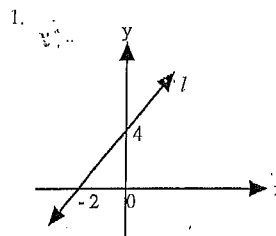
- ii) the square root of the sum of the squares of a and b.

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

SECTION C (18 marks)

ANSWERS

marks



$$\begin{aligned} m &= 2 \\ b &= 4 \end{aligned}$$

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.

$$\begin{aligned} L &= k - mn \\ L - k &= -mn \\ mn &= k - L \\ n &= \frac{k - L}{m} \end{aligned}$$

3. Solve the equations:

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

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

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

$$\begin{aligned} 4n + 6n + 3 &= 12 \\ 10n &= 9 \\ n &= \frac{9}{10} \end{aligned}$$

4. Factorise the following:

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

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

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

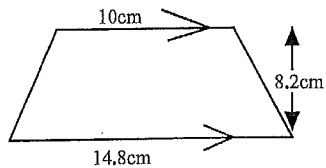
$$y = 2x - 1$$

7. Express with a rational denominator

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

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

8. Find the area of the trapezium



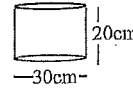
$$A = \frac{1}{2}(a+b) \times h = \frac{8.2}{2}(10+14.8) = 101.68 \text{ cm}^2$$

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)

$$i) V = \pi \times 15^2 \times 20 = 4500\pi \text{ cm}^3$$

-1/2 for no π
-no marks for decimal/no working.

$$ii) SA = 30\pi \times 20 = 600\pi \text{ cm}^2$$

same as i)

$$1/2 \text{ for } 1050\pi$$

$$iii) Capacity \text{ is } 1\text{m}^3 = 1000\text{L}$$

$$\therefore V = 0.04137166 \text{ m}^3$$

$$\therefore Capacity = 14.14716694 = 14 \text{ litres}$$

-1/2 for incorrect rounding.

2. Solve simultaneously using the substitution method:

$$\begin{aligned} 5x - 3y &= 10 & \textcircled{1} \\ x + y &= 9 & \textcircled{2} \end{aligned}$$

from $\textcircled{2}$
 $x = 9 - y$

sub into $\textcircled{1}$
 $5(9-y) - 3y = 10$
 $45 - 5y - 3y = 10$

$$35 = 8y$$

$$\therefore y = \frac{35}{8} \textcircled{1}$$

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

$$x = \frac{37}{8} \textcircled{1}$$

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

$$\begin{aligned} a(3b-2) &= b+1 \\ 3ab - 2a &= b+1 \\ 3ab - b &= 2a+1 \end{aligned}$$

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

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

-1 for 1st error
-1/2 for each extra error.

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

$$\frac{2-a}{(a+2)(a-2)} = \frac{-1}{a+2}$$

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

SECTION D

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.

1/2 for B only

∴ B is a better buy by
~~0.2~~ 0.2^c per 100ml

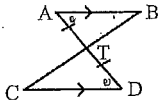
ANSWERS

marks

A = 15.2[¢] per 100ml

B = 15[¢] per 100ml 2

6.



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

AT = TD - given
 ∠BAT = ∠COT (alt ∠s on || lines)
 ∠BTA = ∠CTD (vert opposite)

∴ ΔABT ≅ ΔCOT (AAS) 2

- ① for ≅ test
- ① for stating why AB = CD.

∴ AB = CD corresponding sides in congruent Δ's

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 × 0.5 × 2000 = 2000 m³ ①

1 m³ = 1 kL

∴ 1 hour = 2000 kL

∴ 8 hours = 16 000 kL ①

0.5 | 2



1/2 only for 16 with working
 0 for 16 no working

SECTION E

ANSWERS

marks

1. Factorise

3m² - 11m + 6

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

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

a^{4.5} b⁸

3. Solve the inequality

9a - 4 + 6a ≤ 24

$\frac{3a}{4} - \frac{1-a}{3} ≤ 2$

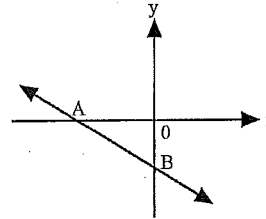
13a ≤ 28

a ≤ $\frac{28}{13}$

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

x-int 3x + 7 = 0
 x = -7/3

y-int 4y + 7 = 0
 y = -7/4



Area = $\frac{1}{2} \times \frac{7}{3} \times \frac{7}{4}$
 = $\frac{49}{24}$

Find the area of triangle AOB.

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

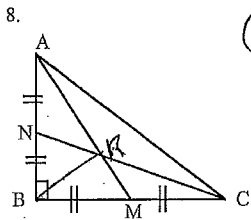
$$S = \frac{D}{T}$$

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

$$\frac{d}{20} + \frac{d}{25} = \frac{5d}{100} + \frac{4d}{100} = \frac{9d}{100}$$

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

$$\frac{9d}{100} = \frac{9}{10} \quad 9d = 90 \quad d = 10 \text{ km}$$



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 AMC

(i) Let $NB = a$.

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

$$5 = 5a^2$$

$$a = 1$$

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

$$= 8$$

$$AC = 2\sqrt{2}$$

$$\text{area } \triangle ARN = \text{area } \triangle NRB = \text{area } \triangle RMB = \text{area } \triangle RMC$$

$$\text{Let area } \triangle RMC = X$$

$$\text{area } \triangle AMB = 3X$$

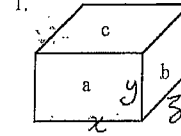
$$1 = 3X$$

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

SECTION F (17 marks)

ANSWERS

marks



The rectangular prism has adjacent faces of area a , b and c units². Find an expression for the volume of the prism in terms of a , b and c .

$$a = xy$$

$$b = yz$$

$$c = xz$$

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

$$xyz = \sqrt{abc}$$

$$V = xyz$$

$$V = \sqrt{abc}$$

2. Sketch the region that is common to the inequalities

$$y \geq 0, x \leq 5 \text{ and } x - 2y - 4 \geq 0$$

$$x - 2y - 4 = 0$$

when $x = 0$,

$$2y = -4$$

$$y = -2$$

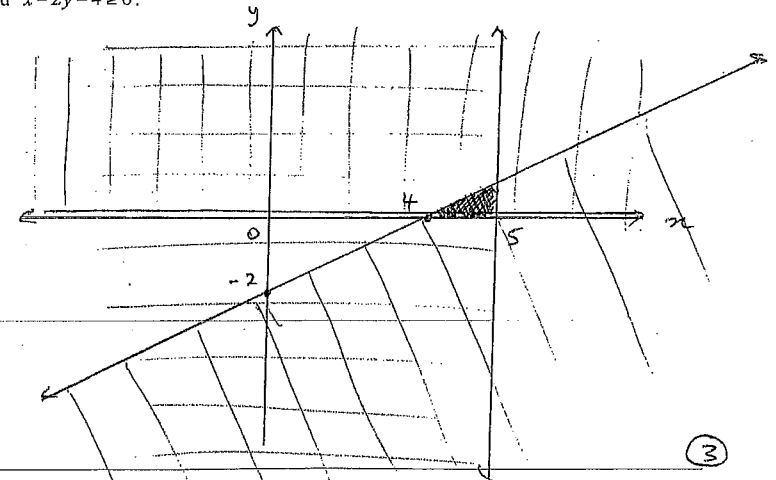
when $y = 0$

$$x = 4$$

$$x - 2y - 4 > 0$$

test (0,0)

$$-4 > 0 \quad \times$$



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 .

$$\begin{aligned}
 &4y = 3x - 12 \\
 &y = \frac{3}{4}x - 3 \\
 &m_1 = \frac{3}{4} \\
 &m_2 = -\frac{4}{3} \\
 &-\frac{a}{b} = -\frac{4}{3} \\
 &a = \frac{4}{3}b \quad \text{--- (1)} \\
 &\text{sub } (5, -2) \text{ into } ax + by + 10 = 0 \\
 &5a - 2b + 10 = 0 \quad \text{--- (2)} \\
 &\text{sub (1) into (2)} \\
 &5\left(\frac{4}{3}b\right) - 2b + 10 = 0 \\
 &\frac{20}{3}b - 2b = -10 \\
 &20b - 6b = -30 \\
 &14b = -30 \\
 &b = -\frac{15}{7} \\
 &\text{sub into (1)} \\
 &a = \frac{4}{3}\left(-\frac{15}{7}\right) \\
 &a = -\frac{20}{7} \quad \text{--- (3)}
 \end{aligned}$$

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

$$\begin{aligned}
 &= xym^2 + xyn^2 + mnx^2 + mny^2 \\
 &= xym^2 + mnx^2 + xyn^2 + mny^2 \\
 &= mx(my + nx) + ny(nx + my) \\
 &= (my + nx)(mx + ny)
 \end{aligned}$$

(2)

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

$$\begin{aligned}
 &= \frac{1}{1 + \sqrt{1+a}} \times \frac{1 - \sqrt{1+a}}{1 - \sqrt{1+a}} + \frac{1}{1 - \sqrt{1-a}} \times \frac{1 + \sqrt{1-a}}{1 + \sqrt{1-a}} \\
 &= \frac{1 - \sqrt{1+a}}{1 - (1+a)} + \frac{1 + \sqrt{1-a}}{1 - (1-a)} \\
 &= \frac{1 - \sqrt{1+a}}{-a} + \frac{1 + \sqrt{1-a}}{a} \\
 &= \frac{\sqrt{1+a} - 1}{a} + \frac{1 + \sqrt{1-a}}{a} \\
 &= \frac{\sqrt{1+a} + \sqrt{1-a}}{a}
 \end{aligned}$$

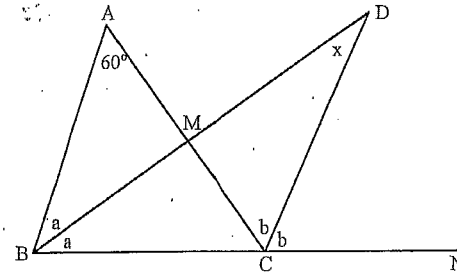
(2)

SECTION F

ANSWERS

marks

6.



From the diagram above find the value of:

i) $b - a$ (giving reasons)

$$\begin{aligned}
 &2b = 60 + 2a \quad (\text{ext. } \angle \text{ of } \triangle) \\
 &2b - 2a = 60 \\
 &2(b - a) = 60 \\
 &b - a = 30^\circ
 \end{aligned}$$

(2)

ii) x (giving reasons)

$$\begin{aligned}
 &b = x + a \quad (\text{ext. } \angle \text{ of } \triangle) \\
 &x = b - a \\
 &x = 30^\circ
 \end{aligned}$$

(1)

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

$$\begin{aligned}
 &= \frac{(5^2)^{2n+1} \times 5^{6-n}}{(5^3)^{1-n} \times 5^{3n}} \\
 &= \frac{5^{4n+2} \times 5^{6-n}}{5^{3-3n} \times 5^{3n}} \\
 &= \frac{5^{3n+8}}{5^3} \\
 &= 5^{3n+5}
 \end{aligned}$$

(2)

THIS IS THE END OF THE EXAM