

SOLUTIONS

5MB2H/01

Edexcel GCSE

Mathematics B (Modular) – 2MB01

Paper 2H (Non-Calculator)

Higher Tier

Practice Paper A

Time: 1 hour 15 minutes



You must have:

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser. Tracing paper may be used.

Instructions

- Use **black** ink or ball-point pen.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- **Calculators must not be used.**

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk (*)** are ones where the quality of your written communication will be assessed
– *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

Advice

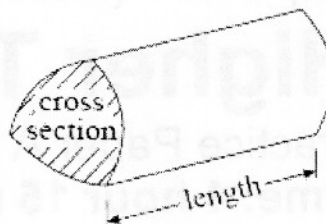
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

GCSE Mathematics 2MB01

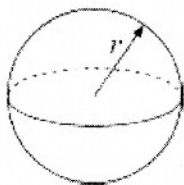
Formulae: Higher Tier

You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.

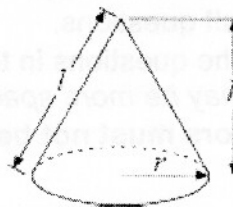
Volume of prism = area of cross section \times length



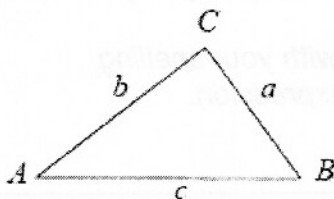
Volume of sphere $\frac{4}{3}\pi r^3$
Surface area of sphere = $4\pi r^2$



Volume of cone $\frac{1}{3}\pi r^2 h$
Curved surface area of cone = $\pi r l$



In any triangle ABC



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2} ab \sin C$

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1. All of the students in a science class went to one revision class.

$\frac{1}{6}$ of the students went to the physics revision class.

$\frac{2}{9}$ of the students went to the biology revision class.

All of the other students went to the chemistry revision class.

What fraction of the students went to the chemistry revision class?

LCM of 6 and 9 = 18 ($3 \times 6 = 18$, $2 \times 9 = 18$) - use for common denominator.

$$\frac{1}{6} + \frac{2}{9} = \frac{3}{18} + \frac{4}{18} = \frac{7}{18} \text{ who do physics or biology.}$$

$$1 - \frac{7}{18} = \frac{18}{18} - \frac{7}{18} = \frac{11}{18} \text{ who went to chemistry.}$$

..... $\frac{11}{18}$

(Total for Question 1 is 3 marks)

2. Bethan uses this formula to work out her gas bill

$$\text{Cost} = \text{Fixed charge} + \text{Cost per unit} \times \text{units used}$$

Last month the Cost of her gas bill was £165

Her fixed charge was £45

The cost per unit was 50p

How many units did she use?

$$165 = 45 + 0.5u, \quad u = \text{number of units}$$

$$0.5u = 165 - 45 = 120$$

$$u = \frac{0.5u}{0.5} = \frac{120}{0.5} = 240 \text{ units}$$

(Total for Question 2 is 3 marks)

*3.

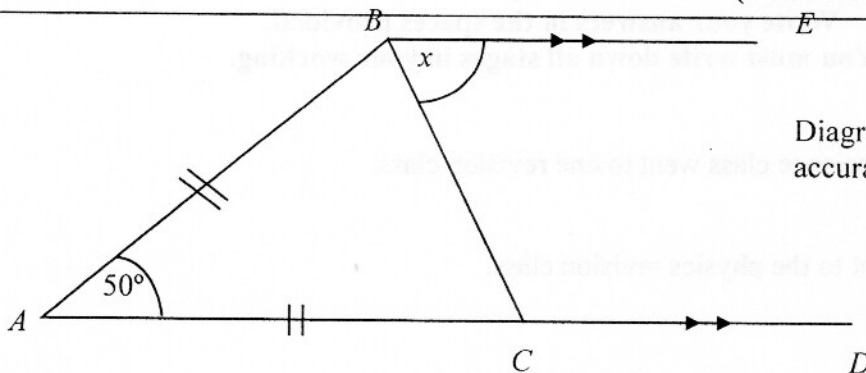
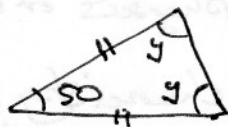


Diagram NOT accurately drawn

ABC is an isosceles triangle.
 $AB = AC$.
 BE is parallel to the straight line ACD .

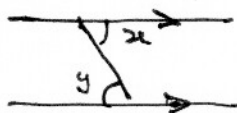
Find the size of the angle marked x .
 You must give reasons for each step in your working.

Since ABC is isosceles, $\angle ABC = \angle BCA$.
 Let $\angle ABC = y$.



$2y + 50 = 180^\circ = \text{angle sum in a triangle}$
 $\therefore 2y = 180 - 50 = 130^\circ$, $y = 130 \div 2 = 65^\circ$

Since BE is parallel to AC , angle $x = \text{angle } y$
 (alternate angles). $\therefore x = 65^\circ$



$x = \dots\dots\dots 65^\circ$

(Total for Question 3 is 5 marks)

4. $F = 1.8C + 32$

$$\begin{array}{r} 1.8 \\ 8 \times \\ \hline 14.4 \\ \hline \end{array}$$

$$\begin{array}{r} 32.0 \\ 14.4 - \\ \hline 17.6 \\ \hline \end{array}$$

(a) Work out the value of F when $C = -8$

$$F = 1.8(-8) + 32 = -14.4 + 32 = 17.6$$

$\dots\dots\dots 17.6$
(2)

(b) Work out the value of C when $F = 68$

$$68 = 1.8C + 32$$

$$68 - 32 = 1.8C$$

$$1.8C = 36,$$

$$C = \frac{1.8C}{1.8} = \frac{36}{1.8} = 20$$

$\dots\dots\dots 20$
(2)

5. Fatima bought 48 teddy bears at £9.55 each.

She sold all the teddy bears for a total of £696.
She sold each teddy bear for the same price.

Work out the profit that Fatima made on the teddy bears.

$$\text{Cost of bears} = 48 \times \text{£}9.55 = 458.40$$



$$\begin{array}{r} 9.55 \\ 48 \cdot \quad \times \\ \hline 76.40 \\ 382.0 \quad + \\ \hline 458.4 \end{array}$$

or

	4	8	.	
4	3	7	2	9
5	2	0	4	5
8	2	0	0	5
	4			

$$\begin{aligned} \text{Profit} &= \text{sale value} - \text{cost} \\ &= 696 - 458.4 = 237.6 \end{aligned}$$

$$\begin{array}{r} 696.0 \\ 458.4 \quad - \\ \hline 237.6 \end{array}$$

£ 237.6

(Total for Question 5 is 4 marks)

6. (a) Work out $\frac{2}{3} - \frac{1}{4}$ LCM of 3 and 4 is 12
 (common denominator).

$$\frac{2}{3} - \frac{1}{4} = \frac{8}{12} - \frac{3}{12} = \frac{5}{12}$$

(Note: In the original image, arrows indicate that the first fraction is multiplied by 4 and the second by 3 to reach the common denominator of 12.)

(b) Work out $2\frac{3}{4} + 5\frac{1}{2}$

$$\dots\dots\dots \frac{5}{12} \dots\dots\dots (2)$$

$$2\frac{3}{4} + 5\frac{1}{2} = 7 + \frac{3}{4} + \frac{2}{4}$$

$$= 7 + \frac{5}{4} = 7 + 1\frac{1}{4} = 8\frac{1}{4}$$

$$\dots\dots\dots 8\frac{1}{4} \dots\dots\dots (3)$$

(Total for Question 6 is 6 marks)

- *7. Amy has a field in the shape of a trapezium.

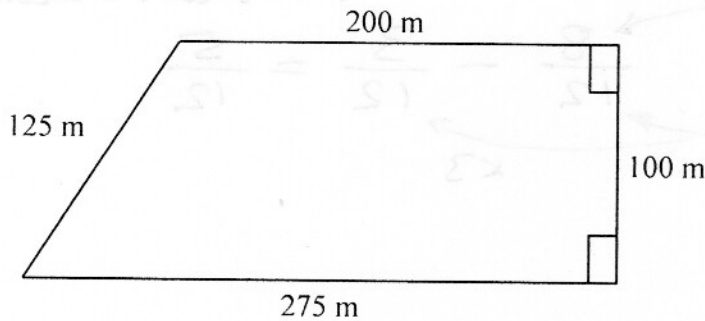


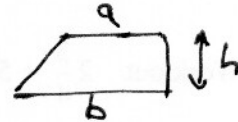
Diagram **NOT** accurately drawn

She wants to sell the field.

Farmer Boyce offers her £1 per m²
Farmer Giles offers her £24 000

Which is the better offer?
You must show **all** your working.

$$\text{Area of a trapezium} = \left(\frac{a+b}{2}\right)h$$



$$\text{Area of field} = \frac{(200+275)}{2} \times 100$$

$$= 475 \times 50 = 237.5 \times 100$$

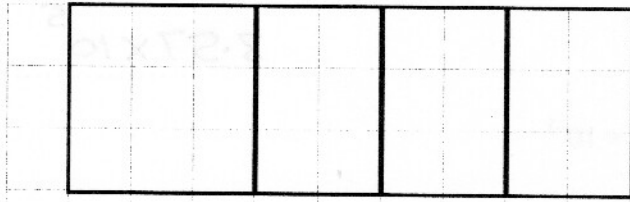
$$= 23750 \text{ m}^2$$

∴ Farmer Boyce offers £1 × 23750 = £23750,
the £24000 offer from Farmer Giles is better,
by £250.

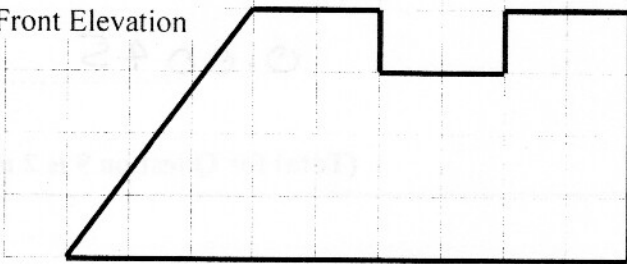
(Total for Question 7 is 4 marks)

8. Here are the plan and front elevation of a prism.
The cross section of the shape is represented by the front elevation.

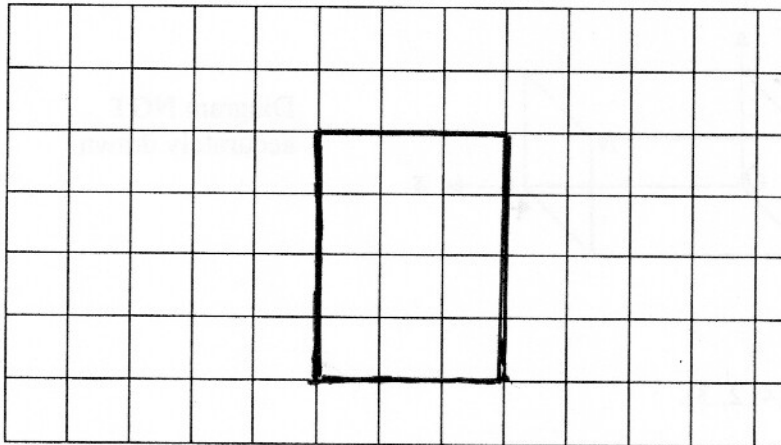
Plan



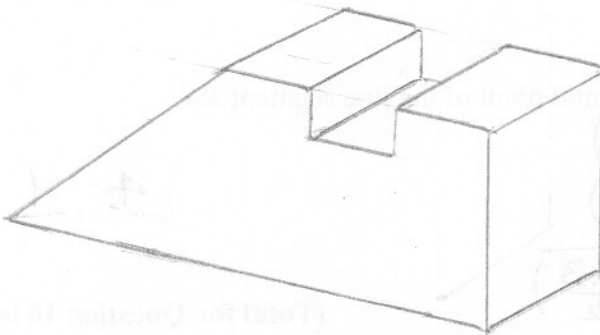
Front Elevation



- (a) On the grid below draw a side elevation.



- (b) In the space below draw a 3D sketch of the shape.



(2)
(Total for Question 8 is 4 marks)

9. (a) Write 357 000 in standard form.

$$3.57 \times 10^5 \dots\dots\dots (1)$$

- (b) Write as an ordinary number 4.5×10^{-3}

$$0.0045 \dots\dots\dots (1)$$

(Total for Question 9 is 2 marks)

10. A cuboid is drawn on a 3-D coordinate grid with one vertex placed at the origin O . It has 3 of its edges lying along the x , y , and z axes.

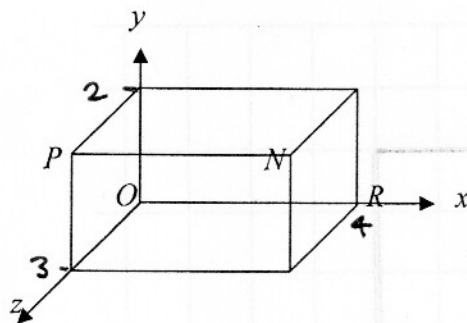


Diagram **NOT** accurately drawn

The point N has coordinates $(4, 2, 3)$.

- (a) What are the coordinates of the point P ?

$$(\dots 0, \dots 2, \dots 3 \dots) (1)$$

- (b) What are the coordinates of the mid point of the line segment RN .

$$R \text{ is } (4, 0, 0)$$

$$N \text{ is } (4, 2, 3)$$

$$(\dots 4, \dots 1, \dots 1\frac{1}{2} \dots) (2)$$

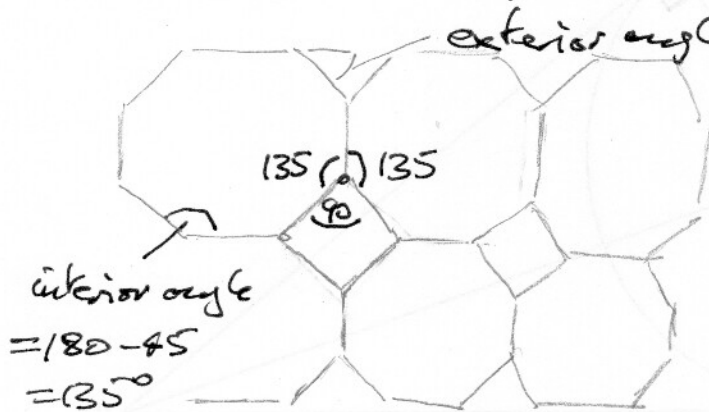
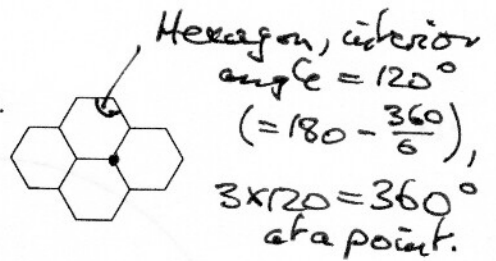
Midpoint $\frac{(4+4, 0+2, 0+3)}{2}$

(Total for Question 10 is 3 marks)

*11. Some regular polygons will tessellate without using another shape.

An octagon and a square will tessellate.

Explain fully, giving reasons, how they do this.



At a corner,
 $135 + 135 + 90$
 $= 270 + 90 = 360^\circ$
 so the edges line up exactly.

interior angle of a square = 90°

(Total for Question 11 is 4 marks)

12. (a) Expand and simplify $(x + 3)(x - 4) = x^2 + 3x - 4x - 12$

$$= x^2 - x - 12 \quad (2)$$

(b) Factorise completely $12p^2q^3 + 18p^3q^2 = 6(2p^2q^3 + 3p^3q^2)$

$$= 6p^2(2q^3 + 3pq^2)$$

$$= 6p^2q^2(2q + 3p)$$

$$\dots 6p^2q^2(2q + 3p) \quad (2)$$

(c) Factorise completely $25x^4 - 49y^2$

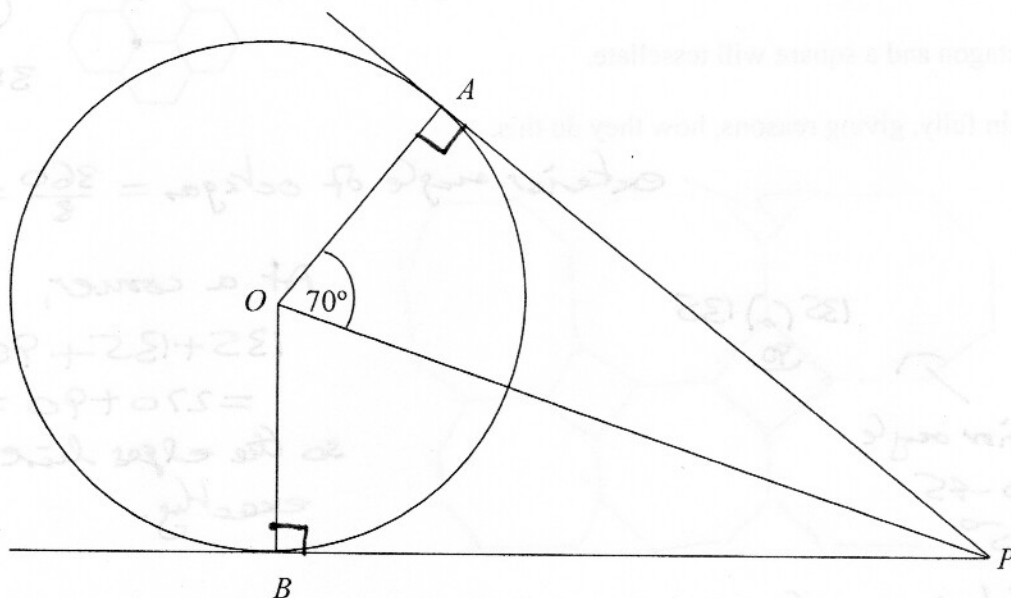
$$25x^4 = (5x^2)^2 \quad \text{and} \quad 49y^2 = (7y)^2$$

"Difference of two squares"

$$\therefore 25x^4 - 49y^2 = (5x^2 + 7y)(5x^2 - 7y) \dots (2)$$

(Total for Question 12 is 6 marks)

*13.



A and B are two points on a circle centre O.

PA and PB are tangents to the circle from P.

Angle AOP = 70°.

(a) Calculate the size of angle APB. $\angle OAP = 90^\circ$.

Angles in triangle OAP add to 180°

$$\angle OPA + 70 + 90 = 180, \quad \angle OPA = 180 - (70 + 90)$$

$\angle OPB = 20^\circ$ also, by symmetry.

$$20 + 20 = 40$$

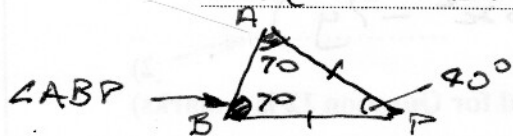
..... 40°
(2)

Angle ABP is 70°.

(b) Explain why.

Triangles OAP and OBP are congruent because they each have a 70° angle, a 90° angle and a common side OP.

Hence AP = BP, triangle ABP is isosceles

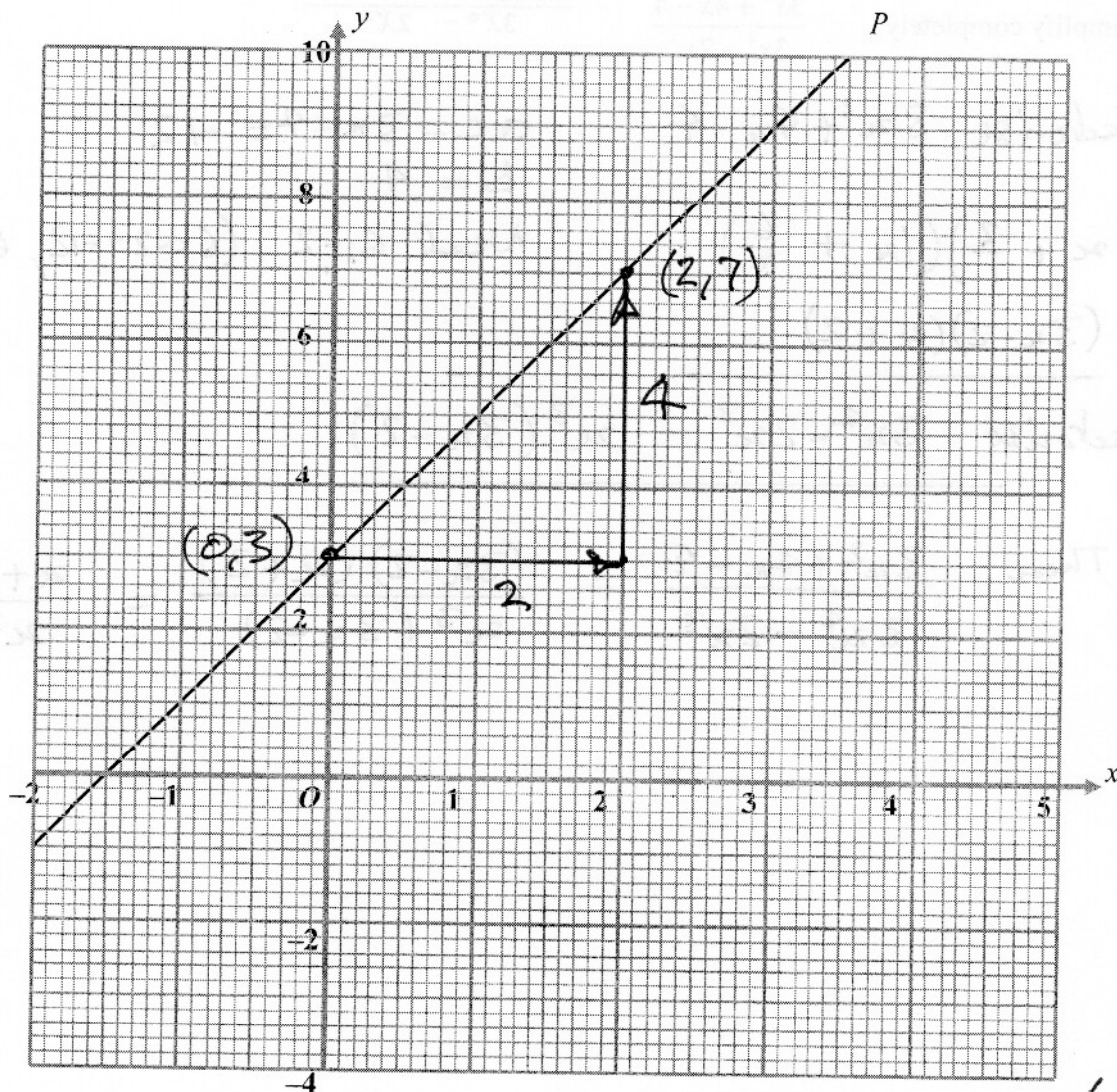


$$70 + 70 + 40 = 180,$$

$$70^\circ = \frac{180 - 40}{2}$$

(Total for Question 13 is 4 marks)

14. The straight line P is drawn on the coordinate grid.



- (a) Find an equation for the straight line P .

y -intercept $c = 3$

$$y = mx + c$$

Gradient $m = \frac{4}{2} = 2$

(up)
(across)

$$y = 2x + 3$$

(3)

- (b) Write down an equation for a straight line that is perpendicular to line P .

Gradient of perpendicular

$$m_p = \frac{-1}{m} = -\frac{1}{2}$$

$$y = -\frac{1}{2}x + c$$

(2)

(Total for Question 14 is 5 marks)

15. Simplify completely $\frac{3x^2 + 4x - 4}{3x^4 - 2x^3}$

Factorise $3x^2 + 4x - 4$.

$ac = 3 \times -4 = -12$
 $b = 4$

$(3x + \frac{-2}{1})(1x + \frac{6}{3})$

Need 6, -2 ($6 \times -2 = -12$, $6 + -2 = 4$).

$= (3x - 2)(x + 2)$

Factorise $3x^4 - 2x^3 = x^3(3x - 2)$

Then $\frac{3x^2 + 4x - 4}{3x^4 - 2x^3} = \frac{(3x - 2)(x + 2)}{x^3(3x - 2)} = \frac{x + 2}{x^3}$

$\frac{x + 2}{x^3}$

(Total for Question 15 is 4 marks)

TOTAL FOR PAPER is 60 MARKS