



Pearson

# Mark Scheme (Results)

## Summer 2017

Pearson Edexcel International GCSE  
In Mathematics B (4MB0) Paper 02

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## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be **prepared to award zero marks if the candidate's response is not worthy of credit** according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the **mark scheme to a candidate's** response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Types of mark
  - M marks: method marks
  - A marks: accuracy marks
  - B marks: unconditional accuracy marks (independent of M marks)
- Abbreviations
  - cao – correct answer only
  - ft – follow through
  - isw – ignore subsequent working
  - SC - special case
  - oe – or equivalent (and appropriate)
  - dep – dependent
  - indep – independent
  - eeoo – each error or omission

- No working
  - If no working is shown then correct answers normally score full marks
  - If no working is shown then incorrect (even though nearly correct) answers score no marks.
- With working
  - If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  - If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.**
  - Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.
  - If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
  - If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.
  - If there is no answer on the answer line then check the working for an obvious answer.
- Ignoring subsequent work
  - It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.
  - It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.
  - Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.
- Parts of questions
  - Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another

1 (a)  $B = \{2, 3, 4, 6, 9, 12\}$

B1 1

$[C = \{4, 6, 8, 9, 10, 12\} \quad C' = \{2, 3, 5, 7, 11\}]$

(b)  $B \cap C = \{4, 6, 9, 12\}$

B1 ft 1

**NB:** (1) ft on (a)

(2) Null set scores B0

(c) One of  $A \cap B = \{2, 4, 6, 12\}$  or  $B \cap C' = \{2, 3\}$

B1 ft

**NB:** ft on (a) and  $A$  or  $C'$  seen

$(A \cap B) \cap (B \cap C') = \{2\}$  (cso)

B1

$n([A \cap B] \cap [B \cap C']) = 1$  (cso)

B1 3 5

**NB:** Condone missing brackets

**Total 5 marks**

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$$2 \text{ (a) } y = 2x - \frac{2}{x} - 3 + \frac{3}{x^2} \quad (\text{allow 1 sign slip, oe}) \quad \text{M1}$$

$$\frac{dy}{dx} = 2 + \frac{2}{x^2} - \frac{6}{x^3} \quad (\text{one term correct – but not from } \frac{d}{dx}(-3))$$

M1(DEP)

All terms correct (oe) A1 3

**[OR Product Method (Not in Spec):**

$$\frac{dy}{dx} = (2x-3) \left( \frac{2}{x^3} \right)' + \left( 1 - \frac{1}{x^2} \right)' (2) \quad (\text{with at least one derivative correct})$$

(M2)

$$\frac{dy}{dx} = 2 + \frac{2}{x^2} - \frac{6}{x^3} \quad (\text{cao}) \text{ (oe)} \quad \text{(A1)}$$

**OR Quotient Method (Not in Spec) :**  $y = \frac{2x^3 - 3x^2 - 2x + 3}{x^2}$

$$\frac{dy}{dx} = \frac{x^2 (6x^2 - 6x - 2) - (2x^3 - 3x^2 - 2x + 3) (2x)}{x^4} \quad (\text{with at least one derivative correct})$$

(M2)

$$\frac{dy}{dx} = 2 + \frac{2}{x^2} - \frac{6}{x^3} \quad (\text{cao}) \text{ (oe)} \quad \text{(A1)]}$$

$$(b) \therefore \frac{dy}{dx}(x=-2) = 2 + \frac{2}{(-2)^2} - \frac{6}{(-2)^3} \quad (\text{subst. } x = -2 \text{ in their answer to (a)}) \quad \text{M1}$$

$$\therefore \frac{dy}{dx}(x=-2) = \frac{13}{4}, 3.25 \quad (\text{cso}) \quad \text{A1 2 5}$$

**Total 5 marks**

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**3 Penalise missing monetary units in answers ONCE only**

$$(a) \$0.60 \times \frac{150}{100} \quad (\text{oe}) \quad \text{M1}$$

$$\$0.90 \text{ (accept 90 cents)} \quad \text{A1} \quad 2$$

$$(b) \text{ Total selling price} = (200 \times \$0.60) \times \frac{120}{100} = \$144.00 \quad \text{M1}$$

To make 20% overall, needs to earn from 80 pineapples = “\$144” – (120 × “\$0.90”) (= \$36.00)

M1(DEP)

$$\text{Selling price per remaining pineapple} = \frac{\text{"\$36.00"}}{80} \quad \text{M1(DEP)}$$

$$\left[ \text{OR Total profit} = \left( (200 \times \$0.60) \times \frac{20}{100} \right) = \$24 \quad (\text{M1}) \right.$$

Allowable loss made on selling remainder “\$0.30 × 120” – “\$24” (= \$12)

(M1(DEP))

$$\text{Price per remaining pineapple} = \$0.60 - \text{"\$12"} / 80 \quad (\text{M1 (DEP)})$$

$$\text{OR } 120 \times 150\% + 80 \times X\% = 200 \times 120\% \quad (\text{oe}) \quad (\text{M1})$$

$$X\% = \frac{200 \times 120\% - 120 \times 150\%}{80} \quad (\text{oe}) \quad (=75\%) \quad (\text{M1(DEP)})$$

$$\therefore \$0.60 \times 75\% \quad (\text{oe}) \quad (\text{M1(DEP)})$$

OR \$X = selling price of the remaining 80 pineapples

$$\therefore \$ (0.9 \times 120) + \$ (80 \times X) = 120\% \times \$ (200 \times 0.6) \quad (\text{oe}) \quad (\text{M1})$$

$$\$X = \frac{\left( \frac{120}{100} \right) \times (200 \times 0.6) - (0.9 \times 120)}{80} \quad (\text{oe}) \quad (\text{M1(DEP)})$$

$$\$X = \frac{\text{"\$36.00"}}{80} \quad (\text{M1(DEP)})$$

(ie has correct method for 120%) ]

$$\text{Selling price of remainder} = \$0.45 \text{ (accept 45 cents)} \quad \text{A1} \quad 4 \quad \mathbf{6}$$

**Total 6 marks**

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$$4 \quad 1 + y^2 = 17, \quad \frac{x}{y} + y^2 = 17, \quad x \frac{1}{y} + y^2 = 17 \quad \text{M1}$$

$$y = 4 \quad (\text{cao}) \quad \text{A1}$$

$$x^2 + yx = 9 + 4x \quad \text{OR} \quad \frac{y}{x} + yz = \frac{y}{x} - 20 \quad (\text{oe})$$

(substitution) M1

$$x = 3 \quad \text{OR} \quad z = -5 \quad (\text{cao}) \quad \text{A1}$$

$$\frac{y}{x} + yz = \frac{y}{x} - 20 \quad (\text{oe}) \quad \text{OR} \quad xy + xz = -3 \quad (\text{oe})$$

(substitution) M1

$$z = -5 \quad \text{OR} \quad x = 3 \quad (\text{cao}) \quad \text{A1} \quad \mathbf{6}$$

**NB: (1)** “x”, “y” and “z” denote use of their numerical values

**(2)** Order of entry on marks into ePEN boxes: M1 A1 for y

M1 A1 for x

M1 A1 for z

**Special Case:** If the cand. has failed to score any marks then recheck their working and award M1 (**only**) for a correct element equation and nothing else.

**Total 6 marks**

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5 (a) $c = 3h$	(oe)	B1	1
(b) $4c + 2h = 700$	(oe)	B1	1
(c) $4 \times "3h" + 2h = 700$	OR $4c + 2\left(\frac{c}{3}\right) = 700$		
OR Correct elimination of one of $c$ or $h$		M1	
One of $h = 50$ or $c = 150$		A1	
Both $h = 50$ and $c = 150$		A1	3
(d) $\frac{2}{3} \times "150" \times £400 + "50" \times £8$		M1	
(£)40 400	(cao)	A1	2 7

**Special Case:** (a)  $3c = h$  B0;

(b)  $4c + 2h = 700$  B1;

(c) Correct elimination of one of  $c$  or  $h$  M1

$c = 70$  and  $h = 210$  A1 A0

(d) M1 A0

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**Total 7 marks**

$$6 \text{ (a) } fg = 2\left(2 - \frac{1}{x}\right) - 3 \quad \text{M1}$$

$$fg: x \mapsto 1 - \frac{2}{x}, \quad \frac{x-2}{x} \quad \text{A1} \quad 2$$

$$\text{(b) (i) } y(1-2x) = 3x \quad \text{OR} \quad x(1-2y) = 3y \quad \text{M1}$$

$$h^{-1}: x \mapsto \frac{x}{3+2x}, \quad \frac{-x}{-3-2x} \quad \text{A1}$$

**NB:** Penalise incorrect notation in their answers to (a) and (b)(i) **ONCE**.

$$\text{(ii) } -\frac{3}{2} \quad \text{OR} \quad x \neq -\frac{3}{2} \quad \text{OR} \quad x = -\frac{3}{2} \quad \text{B1ft} \quad 3$$

**NB:** ft on their inverse function,  $h^{-1}$  (whose denominator must be of the form  $ax + b$ , where  $a$  and  $b$  are constants).

(c)  $x(2x+3) - 2(2x+3) = 2 \times x \times x$  (removing “their” denominators, which must both contain  $x$  and **one** of which must be of the form  $ax + b$ ) (oe)

M1

$$2x^2 + 3x - 4x - 6 = 2x^2 \quad \text{(expanding)} \quad \text{M1 (DEP)}$$

$$\left[ \text{OR } h\left(\frac{fg}{2}\right) = 3 \times \frac{1}{2} \times \left(\frac{x-2}{2x}\right) \times \frac{1}{1-2\left(\frac{x-2}{2x}\right)} = x \quad \text{(oe, eg simplified)} \right.$$

(M1)

$$3x - 6 = x(2x - 2x + 4) = 4x \quad \text{(oe, removing denominators and expanding)}$$

(M1(DEP)) ]

$$x = -6 \text{ (cso)}$$

A1 3 8

**Total 8 marks**

**7 Penalise lack of labelling once only**(a) Triangle  $A$  drawn and labelled B1 1(b) Two *correct* construction lines through  $(-1, 2)$  (oe) M1Triangle  $B = \begin{pmatrix} -5 & -9 & -9 \\ 4 & 4 & -2 \end{pmatrix}$  drawn A2(-1 eeo) 3**NB: (1)** Award M1 A2 if  $(-1, 2)$  not indicated and no construction lines but  $\Delta B$  drawn correctly**(2)** Award M1 A1 if  $(-1, 2)$  not indicated and no construction lines but 2 out of 3 coordinates of  $\Delta B$  drawn correctly**(3)** Deduction of the loss of A marks starts from the last box in ePEN(c)  $\begin{pmatrix} -\frac{1}{2} & 0 \\ 2 & -\frac{1}{2} \\ 0 & 2 \end{pmatrix} \begin{pmatrix} -5 & -9 & -9 \\ 4 & 4 & -2 \end{pmatrix}$ , M1**NB:** Allow **at most** one coord incorrectly stated in their matrix

$$= \begin{pmatrix} \frac{5}{2} & \frac{9}{2} & \frac{9}{2} \\ -2 & -2 & 1 \end{pmatrix} \quad (\text{cao}) \quad \text{A1}$$

Triangle  $C$  drawn A1 ft 3**NB: (1)** ft on their triangle  $B$ **(2)** Correct triangle  $C$  drawn with no working scores full marks **but****(3)** If triangle  $B$  is not fully correct, then we must see working for any marks – even if triangle  $C$  is drawn correctly.

(d) Translation B1

$$\begin{pmatrix} 3 \\ -\frac{3}{2} \\ 3 \end{pmatrix} \quad \text{B1 } (-3/2)$$

B1 (3) 3

**NB: (1)** In ePEN, score the last two Bs as B1 B0 if not given as a column vector and no explanation.**(2)** If more than one transformation stated, score B0 B0 B0

[OR Translation (B1)

$1\frac{1}{2}$  in the  $-x$  direction (oe) (B1)

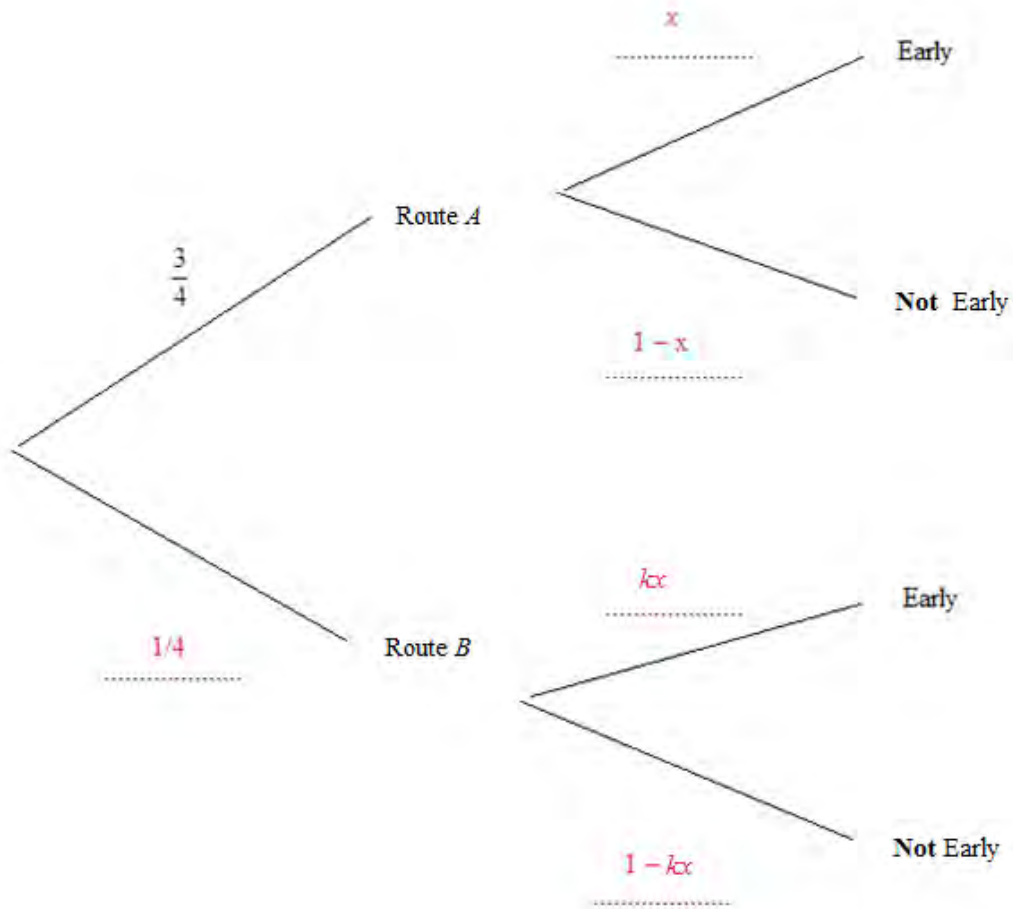
3 in the positive  $y$  direction (oe) (B1) 3]

10

**Total 10 marks**

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8 (a)



One branch correct

B1

Two branches correct

B1

All three branches correct

B1 3

**NB:** Penalise incorrect branches from the end box in ePEN

(b)  $\frac{3}{4}x$

B1 1

(c) " $\frac{3}{4}x = \frac{1}{8}$ " (oe)

M1

$x = \frac{1}{6}$  (oe), awrt 0.167,  $0.1\dot{6}$ , 16.7% (cso)

A1 2

(d) " $\frac{1}{4}(1-kx) = \frac{1}{10}$ " (oe)

M1

$$\frac{1}{4}\left(1 - k \frac{1}{6}\right) = \frac{1}{10} \quad (\text{subst. "x", oe}) \quad \text{M1 (DEP)}$$

$$k = \frac{18}{5}, 3.6, 3.59 \text{ (if using 0.167)} \quad (\text{cso}) \quad \text{A1} \quad 3$$

$$\text{(e) } \frac{3}{4}\left(1 - \frac{1}{6}\right) \quad \text{M1}$$

$$\frac{3}{4}\left(1 - \frac{1}{6}\right) + \frac{1}{10} \quad \text{OR} \quad \frac{3}{4}\left(1 - \frac{1}{6}\right) + \frac{1}{4}\left(1 - \frac{18}{5} \times \frac{1}{6}\right)$$

$$\left( = \frac{3}{4} \times \frac{5}{6} + \frac{1}{4} \times \frac{2}{5} \right) \quad \text{M1 (DEP)}$$

**[OR Complementary approach:**

$$\frac{3}{4} \times \frac{1}{6} + \frac{1}{4} \times \frac{18}{5} \times \frac{1}{6} \quad (\text{M1})$$

$$1 - \left( \frac{3}{4} \times \frac{1}{6} + \frac{1}{4} \times \frac{18}{5} \times \frac{1}{6} \right) \quad (\text{M1(DEP)})]$$

$$\frac{29}{40}, 0.725, 72.5\% \quad (\text{cso}) \quad \text{A1} \quad 3 \quad 12$$

**Total 12 marks**

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**9 Penalise not corrected answers ONCE only**

$$(a) (i) FE = \frac{7}{\tan 30} \quad \text{M1}$$

$$\text{OR } \left[ \sin 30 = \frac{7}{DE} \quad (DE = 14) \text{ and } FE = \sqrt{14^2 - 7^2} \quad (\text{M1}) \right]$$

$$FE = 7\sqrt{3} = 12.12... \rightarrow \mathbf{12.1} \text{ (cm)} \quad \text{A1}$$

**NB: Accept  $7\sqrt{3}$  as a correct, but not corrected, answer**

$$(ii) AF = \sqrt{(10^2 - 7^2)} \quad (\text{oe}) \quad \text{M1}$$

$$AE = "FE" + "AF" \quad (= 7\sqrt{3} + \sqrt{51} = 19.26578408) \quad \text{M1(DEP)}$$

$$\text{OR } \left[ \sin \angle DAF \quad \text{OR} \quad \cos \angle ADF = \frac{7}{10} \text{ so that } \angle DAF = 44.4 \quad \text{OR} \quad \angle ADF = 45.6 \right. \\ \left. (\text{M1}) \right]$$

$$(\therefore \angle ADE = 105.6)$$

$$AE = \frac{10 \times \sin 105.6}{\sin 30} \quad (\text{M1(DEP)}) \left. \right]$$

$$AE = \mathbf{19.2} \text{ (from 3sf), } \mathbf{19.3} \text{ (cm)} \quad \text{A1}$$

$$(iii) EB = \sqrt{(40^2 - "AE"^2)} \quad (= \sqrt{1228.829564}) \quad (\text{oe}) \quad \text{M1}$$

$$EB = \mathbf{35.0} \text{ (from 19.3), } \mathbf{35.1} \text{ (cm)} \quad \text{A1} \quad 7$$

(b) **Triangle CXB Method:**

$$\tan \angle XCB = \frac{"FE"}{30} \quad (\angle XCB = 22.0) \quad \text{M1}$$

$$\sin \angle ABC = \frac{"AE"}{40} \quad (\angle ABC = \mathbf{28.7} \text{ (from 3sf), } \mathbf{28.8}) \quad \text{M1}$$

$$\angle CXB = 180 - (" \angle XCB " + " \angle ABC ") \quad (= 129.2, 129.3 \text{ (3 sf)})$$

M1 (DEP)

**NB: Use the above ordering of the M1s when entering marks into ePEN**

$$\frac{CX}{\sin \angle ABC} = \frac{(30 + "EB")}{\sin \angle CXB} \quad \text{M1 (DEP)}$$

$$CX = \frac{(30 + "EB") \times \sin " \angle ABC"}{\sin " \angle CXB"} \quad \text{M1 (DEP)}$$

**OR** [  $CX = CF + FX$  Method

$$\tan \angle XCB = \frac{"FE"}{30} \quad (\angle XCB = 22.0) \quad \text{(M1)}$$

$$\sin \angle ABC = \frac{"AE"}{40} \quad (\angle ABC = \mathbf{28.7} \text{ (from 3sf), } \mathbf{28.8}) \quad \text{(M1)}$$

$$\angle XAF = 180 - (90 + " \angle ABC") \quad (= 61.3) \quad \text{(M1(DEP))}$$

**NB:** Use the above ordering of the M1s when entering marks into ePEN

$$\cos " \angle XCB" = \frac{30}{CF} \quad (CF = 32.36) \quad (\text{oe})$$

**[BUT NB:** can be M1(INDEP) if Pythagoras used for  $CF$ , for example,

$$CF = \sqrt{30^2 + "FE"}^2$$

and so this method is independent of the first three M marks. ]

$$\text{OR } \frac{FX}{\sin " \angle XAF"} = \frac{"AF"}{\sin (180 - (" \angle XAF" + (180 - (90 + " \angle XCB"))))} \quad (FX = 8.095)$$

ie correct method for  $CF$  (see "**BUT NB**" above) OR  $FX$   
(M1(DEP))

(  $\angle AFX = 68, \angle AXF = 50.7$  )

$$CX = "CF" + "FX" \quad \text{(M1(DEP))}$$

**NB:** Must have correct method for **both**  $CF$  and  $FX$  for above M1(DEP) ]

**OR** [  $\triangle ACX$  Method

$$\tan \angle XCB = \frac{"FE"}{30} \quad (\angle XCB = 22.0) \quad \text{((M1))}$$

$$\sin \angle ABC = \frac{"AE"}{40} \quad (\angle ABC = 28.7 \text{ (from 3sf), } 28.8) \quad ((M1))$$

**NB:** Use the above ordering of the M1s when entering marks into ePEN

$$AC = \sqrt{(40^2 + (30 + "EB")^2 - 2 \times 40 \times (30 + "EB") \times \cos \angle ABC)}$$

$$(AC = 35.6536)$$

((M1(DEP)))

$$\angle CAB: \quad \frac{\sin \angle CAB}{(30 + "EB")} = \frac{\sin \angle ABC}{"AC"} \quad (\angle CAB = 118.498, \text{ NB it's obtuse})$$

((M1(DEP)))

$$CX: \quad \frac{CX}{\sin \angle CAB} = \frac{"AC"}{\sin (" \angle XCB " + " \angle ABC ")} \quad ((M1(DEP))) ]$$

$$CX = 40.3, 40.4, 40.5 \text{ (m)}$$

A1    6    13

**Total 13 marks**

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$$10 \text{ (a) (i) } \overline{OC} = \mathbf{a} + 2\mathbf{b} \quad \text{B1}$$

$$\text{(ii) } \overline{BC} = -\mathbf{b} + \mathbf{a} + 2\mathbf{b} \quad \text{M1}$$

$$\overline{BC} = \mathbf{a} + \mathbf{b} \quad \text{A1}$$

$$\text{(iii) } \overline{AD} = 2\mathbf{b} - \frac{2}{3}(\mathbf{a} + \mathbf{b}) \quad \text{OR} \quad \overline{AD} = -\mathbf{a} + \mathbf{b} + \frac{1}{3}(\mathbf{a} + \mathbf{b}) \quad \text{M1}$$

$$\overline{AD} = -\frac{2}{3}\mathbf{a} + \frac{4}{3}\mathbf{b} \quad \text{(oe)} \quad \text{A1} \quad 5$$

$$\text{(b) } \overline{AE} = n\mathbf{b} - \mathbf{a} \quad \text{B1} \quad 1$$

$$\text{(c) } \mathbf{a} = \frac{1}{\lambda} \left( -\frac{2}{3}\mathbf{a} + \frac{4}{3}\mathbf{b} \right) \quad \text{(oe)} \quad \text{M1}$$

**NB:** This must be a **vector** equation.

$$\text{Comp. of } \mathbf{a}: -1 = -\frac{2}{3} \times \frac{1}{\lambda} \quad \text{M1(DEP)}$$

$$\lambda = \frac{2}{3} \quad \text{(cao)} \quad \text{A1}$$

$$\text{Comp of } \mathbf{b}: n = \frac{4}{3} \times \frac{1}{\lambda} \quad \text{M1}$$

$$n = 2 \quad \text{(cao)} \quad \text{A1} \quad 5$$

**NB:**  $n = 2$  can be correctly obtained from a geometric argument eg

$$\Delta s \frac{ADC}{BDE} \text{ are similar AND } \frac{BD}{AD} = \frac{1}{2} \therefore \overline{BE} = \mathbf{b} \quad \text{(M1)} \quad \text{then } n = 2 \quad \text{(A1)}$$

**Special Case:** Cand. uses  $\overline{AE} = \lambda \overline{AD}$  (M0) then (M1) for component of  $\mathbf{a}$ , (M1) for component of  $\mathbf{b}$ , A0 A0

$$\text{(d) } \overline{OA} = \overline{EC} (= -2\mathbf{b} + \mathbf{a} + 2\mathbf{b}) = \mathbf{a} \quad \text{or} \quad \overline{AC} = \overline{OE} = 2\mathbf{b}$$

$$\text{with cc} \quad \text{B1} \quad 1$$

$$\text{(e) Area of } \Delta BDE = \left( \frac{1}{2} \right)^2 \times 30 \quad \text{OR} \quad \left( \frac{1 - \frac{2}{3}}{2} \right)^2 \times 30 \quad \text{M1}$$

$$= 7.5 \quad \text{A1} \quad 2$$

**Total 14 marks**

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11 (a) -1.92 B1  
2.75 B1 2

**NB:** Penalise no **ONCE** only

(b) Curve

-1 mark for

straight line segments (penalise ONCE only)

each point missed

each missed segment

each point not plotted

each point incorrectly plotted

tramlines (penalise ONCE only)

very poor curve

B3ft (-1eeoo) 3

**NB:** (1) Plotting accuracy is  $\pm \frac{1}{2}$  small square

(2) ft just on (-0.5, "-1.92") and (1.5, "2.75")

(3) Deduct errors from the last ePEN box

(c) Tangent drawn at (2, 2.67) M1

(line touching curve at (2, 2.67) and not intersecting curve

((It should hopefully go through

(1.5, 4.67) and (2.5, 0.67)  $\pm \frac{1}{2}$  small square

**but this is not essential for the M1.)**

Tangent is  $y = -4x + 10.67$

$$\frac{\Delta y}{\Delta x} = \frac{"4.67" - "2.67"}{"1.5" - "2"} (= -4.0) \quad \text{M1(DEP)}$$

**NB:** (1) ft from using the coords of a point on their drawn tangent

(2) Use of calculus scores M0 A0

Accept in range  $-4 \pm 0.5$  A1 3

( Range:  $\frac{"4.72" - 2.67}{"1.525" - 2} = -4.32$  and  $\frac{"4.62" - 2.67}{"1.475" - 2} = -3.71$  )

(Scales:  $y$  range  $\pm 0.05$  and  $x$  range  $\pm 0.025$ )

**NB:** coordinates values are  $\pm 0.05$  (which is  $\pm \frac{1}{2}$  small square)

(d) Rewriting  $\frac{8}{3}x^3 + \frac{5}{3}x + \frac{7}{2} = 7x^2$  as

$$-\frac{8}{3}x^3 + 7x^2 - 4 = \frac{5}{3}x \pm \frac{1}{2} \quad (\text{ie allow 1 sign slip}) \quad \text{M1}$$

Correct ie  $= \frac{5}{3}x - \frac{1}{2}$  A1

Draw  $y = \frac{5}{3}x \pm \frac{1}{2}$  B1 ft

(eg ft on line going through “ $(0, -\frac{1}{2})$ ” and “ $(\frac{3}{10}, 0)$ ”  $\pm \frac{1}{2}$  small square)

**NB:** Award B1ft for correct drawing of cand’s “ $y = \frac{5}{3}x - \frac{1}{2}$ ” if A1 above **not** awarded

$-0.55$  A1

$1.21$  A1

$1.97$  A1    6    14

(ft is  $\pm 0.025$  (ss =  $\pm 0.025$ ))

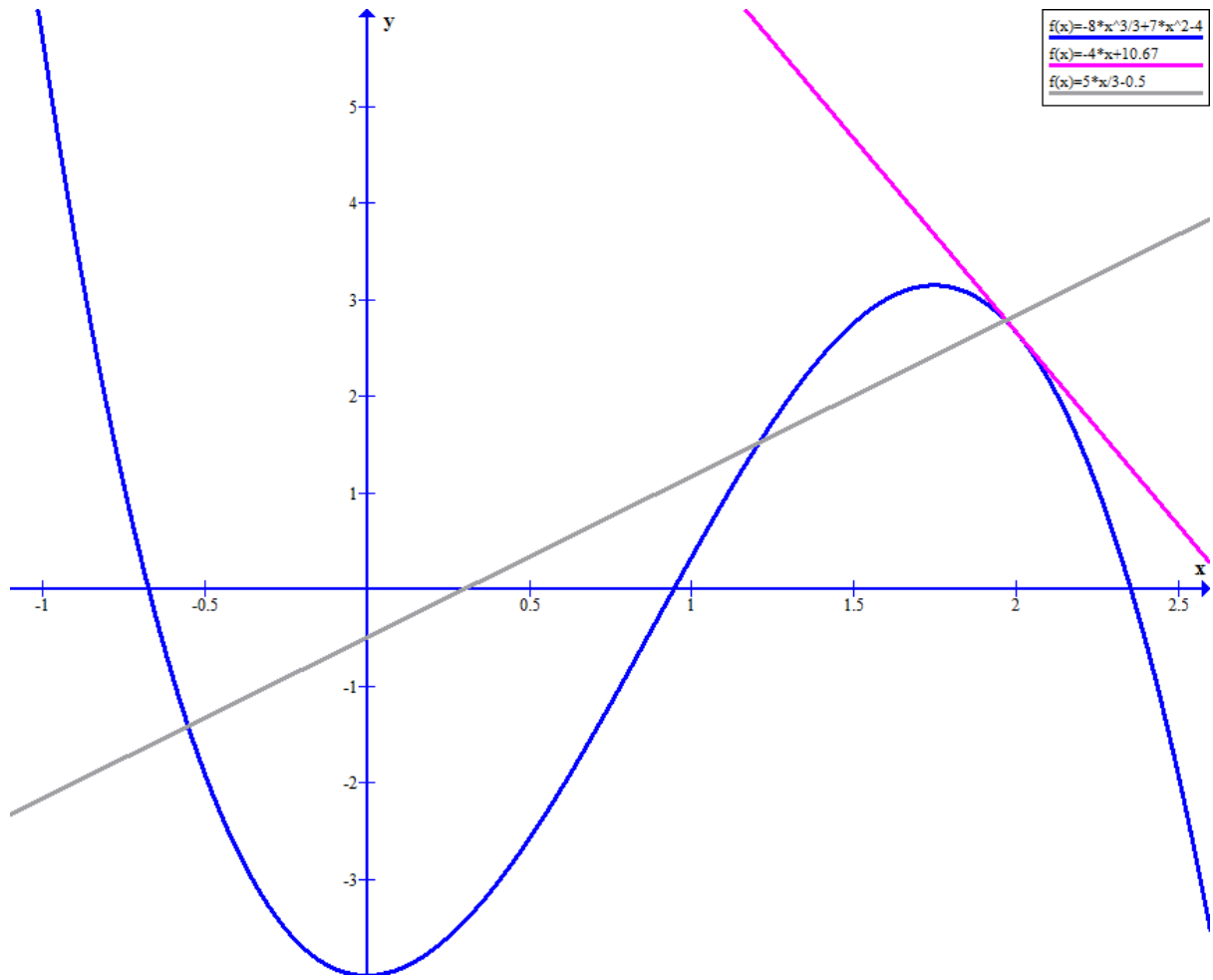
**NB:** (1) The A1s are dependent on the 1<sup>st</sup> A1 **and**  $y = \frac{5}{3}x - \frac{1}{2}$  drawn correctly.

(2) Use the above ordering of the A1ft when entering marks into ePEN

**Total 14 marks**

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**TOTAL 100 MARKS**



29 (a) Relating area to frequency e.g. by showing:

FD of 5 seen or written on top of FD axis oe

OR  $2 \text{ cm} \times 2 \text{ cm square} = (\text{frequency}) 10$

OR  $1 \text{ cm} \times 1 \text{ cm square} = (\text{frequency}) 2.5$

OR  $10 \times 2 \text{ mm squares} = (\text{frequency}) 1$

OR  $1 \times 2 \text{ mm square} = (\text{frequency}) 0.1$  B1

Passengers travelling  $\leq 20$  km:  $2 \times 20$  (using FD  $\times$  width of bar)

$4 \times 10, 16 \times 2.5, 40 \times 1, 400 \times 0.1$

(i.e. method that follows from previous mark) M1

Number of passengers = 40 A1 3

(b) using FDs: number of passengers = "40" + 50 + 4  $\times$  15 + 3  $\times$  5

OR "40" + 50 + 6  $\times$  10 + 1.5  $\times$  10

OR "40" + 50 + 24  $\times$  2.5 + 6  $\times$  2.5

OR "40" + 50 + 60  $\times$  1 + 15  $\times$  1

OR "40" + 50 + 600  $\times$  0.1 + 150  $\times$  0.1

(i.e. 40 + 50 + 60 + 15) M1

Total number of passengers = 165 A1 2

(c)  $\frac{75}{165}, \frac{15}{33}, \frac{5}{11}$  awrt 0.455 B1 1 6

**Total 6 marks**

**TOTAL 100 MARKS**

