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Mark Scheme January 2009

GCE O Level

O Level Mathematics B (7361)

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Mathematics B 7361

Paper 1

1.	(a)	0.0625		B1	1
	(b)	6.25%	(o.e.)	B1 ft	1
					2
					Total 2 marks

2.	an attempt at the bisector of $\angle RPQ$ drawn		M1	
	bisector of $\angle RPQ$ drawn $\pm$ 1mm (ie no daylight)		A1	
				2
				Total 2 marks

3.	$4x - \frac{x}{3} > 10 + 1$	(o.e.)	M1	
	$x > 3$		A1	
				2
				Total 2 marks

4.	(a)	75 mins		B1	1
	(b)	45 mins		B1	1
					2
					Total 2 marks

5.	(a)	0		B1	1
	(b)	2		B1	1
					2
					Total 2 marks

6.	$\frac{54}{A} = \frac{9^2}{4.5^2}$	(o.e.)	M1	
	13.5 cm^2		A1	
				2
				Total 2 marks

7. $4x + x = 180$ M1

36 A1

2

Total 2 marks

8. 11 and 29 clearly identified M1

40 A1

2

Total 2 marks

9. $w = 90^o$ B1

$a = -1$ B1

2

Total 2 marks

10. $\frac{?}{1000} \times 360 = 126$ M1

$? = \frac{126 \times 1000}{360}$ M1 dep

350 red cars A1

3

Total 3 marks

11. **Either:**

$3x - 4 = 3 - 2x$ M1

$3x + 2x = 3 + 4$ (isolating x) M1 dep

$x = \frac{7}{5}$ (o.e.) A1

3

or:

$(y + 4)/3 = (3 - y)/2$ (allow one slip)

$y = 1/5$

substituting c's(1/5) into either equation M1

isolating x M1

$x = \frac{7}{5}$ (o.e.) A1

Total 3 marks

12. (a) 9 km B1 1

(b) $\cos 50 = \frac{\text{c's(9)}}{\text{distance to mast}}$ (o.e.) M1

14.0 km A1 2 **3**

Alternatively:

PM/c's(9) = tan 50 (10.73...)

QM^2 = c's$(9)^2$ + c's$(10.73)^2$ M1

14.0 km A1

Total 3 marks

13. (a) correct line drawn B1

both end points correctly identified with appropriate symbols B1 2

(b) -1, 0 B1 1

3

Total 3 marks

14. (a) 234 B1 1

(b) $\frac{\Sigma \text{ of fish}}{11}$ (sum of 11 terms) M1

266 A1 2 **3**

Total 3 marks

15. **either:**

taking *x* out correctly as a factor
$x(3x^2 + 2x - 1)$ M1

attempt at factorising c's trinomial quadratic
$x (3x - 1) (x + 1)$ M1

$x (3x - 1) (x + 1)$ A1 **3**

or:

attempt at factorising c's trinomial cubic
$(3x^2 - x)(x + 1)$ (o.e.) M1

taking *x* out correctly from their factored form
$x(3x - 1)(x + 1)$ M1

$x (3x - 1) (x + 1)$ A1

Total 3 marks

16. $3x^2 - 2 - \frac{1}{x^2}$ (at least2 terms correct) M1

$3 \times 2^2 - 2 - \frac{1}{2^2}$ (subs $x = 2$) M1 dep

9.75 (o.e.) A1

3

Total 3 marks

17. (a) 4, 10 B1 1

(b) 2 B1 1

(c) 9, 15 B1 1

3

Total 3 marks

18. $OA = OB = \sqrt{\frac{10^2}{2}}$ (7.1...) (o.e.) B1

either $\frac{90}{360}$ x π x c's$(7.1..)^2$ **or** $\frac{1}{2}$ x c's$(7.1)^2$ M1

difference between c's two areas M1 dep

14.3 cm^2 A1

4

Total 4 marks

19. $375 = \frac{k}{2^2}$ M1

$k = 2^2 \times 375$ (1500) (o.e.) M1 dep

c's(k) $\div 5^2$ (o.e.) M1 dep

60 A1

4

Total 4 marks

20. (a) one correctly identified pair of angles equal with reason B1

a second correctly identified pair of angles equal with reason and conclusion B1 2

e.g.

$\angle AED = \angle BEC$ vertically opposite $\angle$s,
$\angle DAC = \angle DBC$ $\angle$s in same segment

(b) $\frac{AE}{BE} = \frac{AD}{BC}$ M1

$AE \times BC = BE \times AD$ A1 2

4

Total 4 marks

21. **Either:**

removing denominators correctly
$(a - x)\,a\,y = a\,(x + ay) + a - x$ M1

expanding terms (one sign error allowed)
$a^2 y - axy = ax + a^2y + a - x$ M1

collecting terms (one sign error allowed)
$x - ax - axy = a$ (o.e.) M1

$x = \frac{a}{1 - a - ay}$ (o.e.) A1 **4**

or:

$\frac{x + ay}{a - x} = y - \frac{1}{a}$

expanding terms (one sign error allowed)
$x + ay = ay - xy - 1 + \frac{x}{a}$ M1

collecting terms (one sign error allowed)
$x + xy - \frac{x}{a} = -1$ M1

removing denominator correctly
$ax + axy - x = -a$ (o.e.) M1

$x = \frac{a}{1 - a - ay}$ (o.e.) A1

Total 4 marks

22. (a) **either:**

18 + n(B) - 7 = 27 (o.e.)

or:

n($B \cap (A \cup C)'$) = 5 (seen) M1

n(B) = 16 A1 2

(b) **either:**

n($A \cap B'$) = 11 and n($C \cap B'$) = 21 – c's(5)

or:

32 + 27 - c's(a) (o.e.) M1

43 A1 2

4

Total 4 marks

23. $\sqrt{20^2 - 12^2}$ (= 16) M1

$\pi \times 12^2 \times c's(16)$ or $\frac{1}{3} \times \pi \times 12^2 \times c's(16)$ M1

$\pi \times 12^2 \times$"16" - $\frac{1}{3} \times \pi \times 12^2 \times$"16" M1 dep

4830 ,4820 (using π = 3.14) A1

4

Total 4 marks

24. -10x^2 + 13x = -3 M1

10x^2 - 13x - 3 (= 0) A1

attempt at solving a trinomial quadratic
(2x - 3) (5x + 1) (= 0) M1

$\frac{3}{2}, \quad -\frac{1}{5}$ (o.e.) A1, A1

5

Total 5 marks

25.	(a)	12%	B1	1	
	(b)	**either:**			
		22	B1		
		(total weight =) 25 + 2x	B1		
		$\frac{\textit{any numerical value}}{25 + 2x} = \frac{2}{3}$	M1		
		4 kg	A1	4	**5**
		or:			
		33	B1		
		(total weight =) 25 + 2x	B1		
		25 + 2x = 33	M1		
		4 kg	A1		
					Total 5 marks
26.	(a)	$\lvert AB \rvert = \sqrt{3^2 + 3^2}$	M1		
		k = 18	A1	2	
	(b)	Correct use of Pythag. on at least one side	M1		
		Correct Pythag. method to find all 3 sides	M1 dep		
		conclusion correctly obtained	A1	3	**5**
		Alternatively:			
		Gradient of OA = 1	M1		
		Gradient of AB = -1	M1 dep		
		Gradient of OA x gradient of AB = -1 So OA is perpendicular to AB	A1		
					Total 5 marks

27. correctly substituting

$\frac{3+x}{3-x}=\frac{x+4}{x-4}$ M1

removing the denominator

$(3 + x)(x - 4) = (x + 4)(3 - x)$ M1 dep

Expanding, allowing one slip max.

$x^2-x-12 = -x^2-x+12$ (o.e.) M1 dep

$2x^2 - 24 (= 0)$ A1

3.46, -3.46 (or equivalent surd form) A1, A1

6

Total 6 marks

28. (a) no gaps and class boundaries correct B1

1 correctly drawn height B1

2 correctly drawn heights B1

all correct B1 4

(0.9, 1.4, 2.3, 1.7 $\pm\frac{1}{2}$ small square)

(b) 10 x c's(0.9) + 10 x c's(1.4) (o.e.) M1

23 goals A1 2

6

Total 6 marks

29. (a) sin $\angle EAD=\frac{3}{10}$ (o.e.) M1

Alternatively:

Using Pythagoras and then
tan $\angle EAD$ = 3/√c's(91)

$\angle EAD$ = 17.5° A1 2

(b) $AD = \sqrt{10^2-3^2}$ (= 9.5394) M1

tan(20 + c's($\angle EAD$)) = $\frac{BD}{c's(AD)}$ M1 dep

BD = 7.30, 7.31, 7.32 A1 3

(c) $\Delta ABC=\frac{1}{2}\times(2\times c's(AD))\times c's(BD)$ (o.e.) M1

ΔABC = 69.5 → 69.8 cm² A1 2 **7**

Total 7 marks

Paper 2

1. 3.6 B1

$\frac{"3.6"^3 - 3.0^3}{3.0^3} \times 100$ o.e M1

72.8% A1

3

Total 3 marks

2. (a) 3 cm = 1.2 × 1000 × 100 cm o.e M1

1: 40 000 A1 2

(b) 1.6 = Area × $\left(\frac{"40000"}{1000 \times 100}\right)^2$ o.e M1

10 cm^2 A1 2

4

Total 4 marks

3. (a) 12*t* - 3 (1 term correct namely 12*t*) M1

"12*t* - 3" = 21 M1 DEP

2 secs A1 3

(b) $"\frac{dv}{dt}" = 12$ (differentiating) M1

c.c A1 2

5

Total 5 marks

4. $\frac{x(x-3)+12x}{2(x-3)} = 1$ (combining fractions) M1

$x^2 + 9x = 2x - 6$ (elim. denominator) M1 DEP

NB: A total of 1 slip is allowed for *both* of the above 2 Ms

$x^2 + 7x + 6 = 0$ A1

$(x + 1)(x + 6) = 0$ (solving trinomial quadratic) M1 INDEP

-1 A1

-6 A1

6

Total 6 marks

5. (a) $\frac{12}{25}$, 0.48. 48% B1 1

(b) $\frac{6}{25}$, 0.24, 24% B1 1

(c) $\frac{1}{25}$, 0.04, 4% B1 1

(d) $\frac{3}{25}$ B1

$\frac{3}{25} \times \frac{2}{24}$ M1

$\frac{1}{100}$, $\frac{6}{600}$, 0.01, 1% A1 3

(e) $\frac{2}{25}$ B1

$\frac{2}{25} \times \frac{1}{24}$ M1

$\frac{1}{300}$, $\frac{2}{600}$, 0.0033, 0.33% or better A1 3

9

Total 9 marks

6. (a)(i) 4 B1

(ii) [3(„4"-1) =]9 B1 ft 2

(b) $y + 3 = 3x$ (1 slip but isolating x) o.e M1

$f^{-1} : x \mapsto \frac{x+3}{3}$ cao A1 2

(c) $hfg(x) = \left[\frac{3}{x}(1-x)\right]^2$ o.e (1 slip) M1

$\frac{1}{x} - 1 = \pm 2$ o.e OR $1 + x^2 - 2x = 4x^2$ o.e (eliminating denominator and multiplying out brackets) M1 DEP

$x_{\pm} = \frac{1}{\pm 2 - 1}$ OR $(3x - 1)(x + 1) = 0$ (solving quadratic) M1 DEP

$x = \frac{1}{3}, \frac{9}{27}$, 0.333 or better A1

-1 A1

5

9

S.C: $\frac{1}{x} - 1 = 2$ scores M1 M0 A0 A0

Total 9 marks

7. (a) $\frac{(2\times 8-4)\times 90}{8}$ M1

135° A1 2

(b) $\angle EFD = \frac{180-"135"}{2}$ M1

22.5° A1 2

(c) $\angle DHE = 67.5^o$ OR $\angle FXD = 90^o$ B1

$\angle XDF = 45^o$ B1 2

(d) $\angle CBY = 67.5^o$ (symmetry of *FBCDE* and *FGHAB*) B1

$\angle BCY = 45^o$ ($\angle$s of quad. and symmetry) B1

$\angle BYC = 67.5^o$ ($\angle s$ of Δ) B1

c.c (eg 2 angles equal $\therefore \Delta BYC \therefore \Delta BYC$ is isosceles) B1 4

10

[**S.C.:** No reasons, and $\angle CBY = 67.5^o$ and $\angle BYC = 67.5^o$ B1

$\angle CBY = 67.5^o$ and $\angle BYC = 67.5^o$ and 1 reason for 67.5 angle B1

$\angle CBY = 67.5^o$ and $\angle BYC = 67.5^o$ and 2 reasons for 67.5 angle B1

c. c. B1

Total 10 marks

8. (a) (i) **a** - **b** B1

(ii) $\frac{2}{3}$ (**a** - **b**) B1 ft

(iii) $\frac{1}{2}$ **b** B1

(iv) "$\frac{1}{2}$ **b**" + "$\frac{2}{3}$ (**a** - **b**)" M1

$\frac{2}{3}$ **a** - $\frac{1}{6}$ **b** o.e A1 5

(b) $\overrightarrow{MP}$ = "**2a**" " - $\frac{1}{2}$**b**" or $\overrightarrow{NP} = \frac{4}{3}$**a** - $\frac{1}{3}$**b**

M1

$\overrightarrow{MP}$ = 3 $\overrightarrow{MN}$ = $\frac{3}{2}\overrightarrow{NP}$ or $\overrightarrow{NP} = 2\overrightarrow{MN}$ M1 DEP

correct conclusion A1 3

[**NB:** Dividing vectors leading to $\overrightarrow{MP}$ = 3 $\overrightarrow{MN}$ = $\frac{3}{2}\overrightarrow{NP}$ or $\overrightarrow{NP} = 2\overrightarrow{MN}$

scores M1 (for $\overrightarrow{MP}$ or $\overrightarrow{NP}$) M1 A0]

(f) $\overrightarrow{NP}$ = $\frac{2}{3}$ "(**2a** - $\frac{1}{2}$**b**)" = 2$\overrightarrow{MN}$ M1

1 : 2 A1 2

[NB: Dividing vectors leading to 1 : 2 scores M1 A0]

10

Total 10 marks

9. NB: Penalise omission of labelling or incorrect labelling ONCE only

(a) ΔABC drawn and labelled B1 1

(b) (i) $\begin{pmatrix} -1 & -2 & -4 \\ -2 & -4 & -3 \end{pmatrix}$ o.e B2 (-1 eeoo)

(ii) $\Delta A_1B_1C_1$ drawn and labelled B2 (-1 eeoo) ft 4

(c) ($\Delta A_2B_2C_2$ = $\begin{pmatrix} 3 & 4 & 6 \\ -2 & -4 & -3 \end{pmatrix}$)

$\Delta A_2B_2C_2$ drawn and labelled B2 (-1 eeoo) ft 2

(d) (i) Reflection in the line *y* = *x* B1

(ii) $\begin{pmatrix} -2 & -4 & -3 \\ 3 & 4 & 6 \end{pmatrix}$ o.e B2 (-1 eeoo)

(iii) $\Delta A_3B_3C_3$ drawn and labelled B2 (-1 eeoo) 5

(e)

n = $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$ B2 (-1 eeoo) 2

14

Total 14 marks

10. NB: Penalise not corrected answers ONCE only

(a) *FG* = 6 B1

$\sqrt{20^2 + 6^2}$ M1

20.9 A1 3

OR *AF* = 7.81 B1

(*EB* = 21.5)

EG = $\sqrt{(21.5^2 - 5^2}$ M1

20.9 A1

(b) $\frac{1}{2} \times "20.9" \times 10$ M1

104.4, 104.5, 104.6 A1 2

OR ($\angle EBG = 76.55^o$)

$\frac{1}{2} \times 10 \times "21.5" \times \sin "76.55"$ M1

104.4, 104.5, 104.6 A1

(c) $\sqrt{5^2 + "20.9"^2}$ M1

21.5 A1 2

OR *FB*=7.81

EB = $\sqrt{(20^2 + "7.81"^2}$ M1

21.5 A1

(d) "104.4" = $\frac{1}{2} \times "EB" \times "EB" \times \sin \angle AEB$ M1

$\sin \angle AEB = \frac{"104.4"}{\frac{1}{2} \times "461"}$ M1 DEP

27° A1 3

OR $\sin \angle EGB = \frac{5}{"21.5"}$ o.e M1

$\angle AEB = 2 \times "13.48"$ M1 DEP

27° A1

OR 12^2 = "21.5"^{2} + "21.5"^{2} -2x21.5x21.5x cos $\angle BEC$

M1

$\therefore \cos \angle BEC = \frac{"21.5"^2 + "21.5"^2 - 12^2}{2 \times "21.5" \times "21.5"}$ M1 DEP

27° A1

(e) $EN = \sqrt{"EB"^2 - 6^2}$

(N is the mid-pt of BC, say) M1

$\Delta EBC = \frac{1}{2} \times "EN" \times 12$ M1 DEP

Total surface area

$= 2 \times ("\Delta EBC") + 2 \times "104.4" + 10 \times 12$ M1 DEP

576.2 $\rightarrow$ 576.6 A1 4 **14**

OR $\angle BEC = 2 \times 16.2$ M1

$\Delta EBC = \frac{1}{2} \times "21.5"^2 \times \sin "32.4"$ M1 DEP

Total surface area

$= 2 \times ("\Delta EBC") + 2 \times "104.4" + 10 \times 12$ M1 DEP

Total 14 marks

11. (a) 1.88, 2.13, -3.13 B1, B1, B1 3

NB: Ordering of the award of the B marks

(b) -1 mark for
straight line segments
each point missed
each missed segment
each point not plotted
each point incorrectly plotted
tramlines in 2 segments
very poor curve B3 3

NB: Ordering of the award of the B marks - award all 3 B marks and then deduct, beginning with the 3rd one for any errors.

(c) -1.66 B1 ft
-0.21 B1 ft
2.87 B1 ft
$-0.21 < x < 2.87$ B1 ft
4

NB: 'ft' on candidates' curve

(d) Rewrite $2x^3 - 2x^2 - 11x - 1 = 0$ as
$x^3 - x^2 - 5x = \frac{1}{2} + \frac{1}{2}x$ (ie attempting to isolate $x^3 - x^2 - 5x$)
M1
correctly A1
Draw $y = \frac{1}{2}(1 + x)$ ie straight line going
through (-1, 0) and (0, $\frac{1}{2}$) A1
-1.84, -0.09, 2.93 A1 ft
-0.09 A1 ft
2.93 A1ft
6

16
Total 16 marks

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