**Question 2** (12 marks). Use a SEPARATE Writing Booklet. **Marks**

(a) Evaluate $|-7|-|-9|$ **2**

(b) Given $f(x)=x-\frac{1}{x}$ evaluate $f(\frac{1}{2})$ **1**

(c) Find the area of the triangle formed by the line $3x+8y-4=0$ and the $x$ and $y$ axes. **2**

(d) Solve for $x$: $|x-3|>2$ **2**

(e) Write down the equation of the circle with centre at the origin and passing through the point (5,7). **2**

(f) Find the equation of the line passing through the point (3,0) and the point of intersection of the lines $x+y+1=0$ and $2x-y-4=0$. **3**

**Question 3** (12 marks). Use a SEPARATE Writing Booklet.

(a) Given that $\sin\theta=\frac{3}{\sqrt{15}}$ and $\cos\theta<0$, find the exact value of $\tan\theta$. **2**

(b) Simplify $\frac{\sin(90^0-\theta)}{\sin(180^0-\theta)}$. **2**

(c) Solve for $\theta$: $\sin\theta=-0.5$ for $0\le\theta\le360^0$ **2**

(d) In an isosceles triangle the equal sides measure 15cm and the equal angles measure $37^0$. Find the length of the remaining side, correct to 2 significant figures. **3**

(e) Draw, on separate axes, a possible graph of the quadratic function of the form $y=ax^2+bx+c$.

(i) if $a<0$ and $\Delta>0$ **1**

(ii) if $a>0$ and $\Delta<0$ **1**

(iii) if $a>0$ and $\Delta=0$ **1**

**Question 4** (12 marks) Use a SEPARATE Writing Booklet.

Marks

On separate number planes, draw neat sketches, showing important features, of the following:

(a) $f(x) = 2 - x^2$ — 2

(b) $f(x) = (x-1)^2$ — 2

(c) $x^2 + y^2 = 5$ — 2

(d) $y = \dfrac{1}{x+2}$ — 2

(e) $f(x) = \begin{cases} x^2, & \text{for } x \le 0 \\ x+1, & \text{for } x > 0 \end{cases}$ — 2

(f) $f(x) = \sqrt{4-x}$ — 2

**Question 5** (12 marks) Use a SEPARATE Writing Booklet.

(a) Differentiate the following functions:

(i) $y = x^2 + \dfrac{1}{3x^5}$ — 2

(ii) $y = \dfrac{x}{2x-1}$ — 2

(iii) $y = (x^2 - x)^4$ — 2

(iv) $y = x^3(x-1)^5$, leaving your answer in fully factorised form. — 3

(b) What can be said about the function $y = f(x)$ if:

(i) $f'(x) = 0$ for all values of $x$. — 1

(ii) $f'(x)$ is a linear function. — 1

(iii) $f(a) = -f(-a)$ — 1

Marks

**Question 6** (12 marks). Use a SEPARATE Writing Booklet.

(a) Given the points $P(2,-2)$ and $Q(-4,6)$,

(i) find the length of the interval $PQ$ — 1

(ii) show that the midpoint of $PQ$ is (-1,2). — 1

(iii) find the equation of the straight line joining the point (4,-3) to the midpoint of $PQ$. — 2

(b) Find the equation of the straight line that is perpendicular to $y = 5x + 2$ and passes through (1,5). — 2

(c) Find distance from the point (1,-2) to the line $y = x + 6$ — 3

(d) Shade the region on the number plane for which $y \geq x^2 + 4x$ and $y \leq x + 1$ hold simultaneously. — 3

**Question 7** (12 marks) Use a SEPARATE Writing Booklet.

(a) Given the quadratic function $y = x^2 + x + 1$ whose roots are $\alpha$ and $\beta$, write down the value of:

(i) $\alpha + \beta$ — 1

(ii) $\alpha\beta$ — 1

(iii) $\frac{1}{\alpha} + \frac{1}{\beta}$ — 2

(iv) $\alpha^2 + \beta^2$ — 2

(b) Given a function $y = x^2 + x$,

(i) find the gradient of the tangent to the curve at the point $A$ (-1,0). — 2

(ii) show that the equation of the normal at $A$ is $x - y + 1 = 0$. — 2

(iii) find the coordinates of the point $B$ where the normal meets $y = x^2 + x$ again. — 2

**Question 8** (12 marks) Use a SEPARATE Writing Booklet. **Marks**

(a) Factorise fully, the following:

(i) $x^4 + 125x$ **2**

(ii) $40x^2 + 11x - 2$ **2**

(iii) $100 - (40 - t)^2$ **2**

(b) State the largest possible domain for the function $f(x) = \dfrac{3}{x^2 - 4}$ **2**

(c) What is the minimum value of $f(x) = x^2 - 10x + 21$? **2**

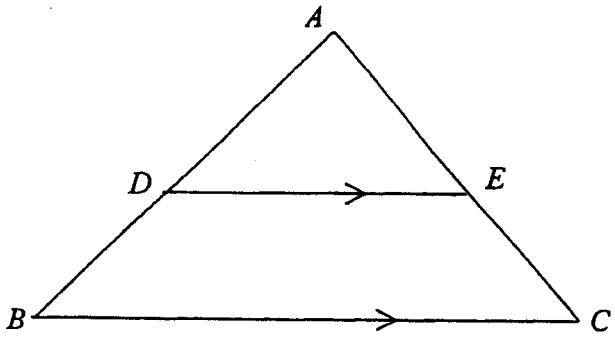
(d) If $f(x) = x^2 - 2x + 4$ find the value(s) of $x$ for which $f(x) = 7$ **2**

**Question 9** (12 marks). Use a SEPARATE Writing Booklet.

(a) Solve $(3^x - 1)(3^x - 9) = 0$ **2**

(b) Explain why there is no solution to $2 - \cos x = 0$ **1**

(c)




NOT TO SCALE

In the diagram, $ABC$ is an isosceles triangle where $AB = AC$.
$DE$ is parallel to $BC$.

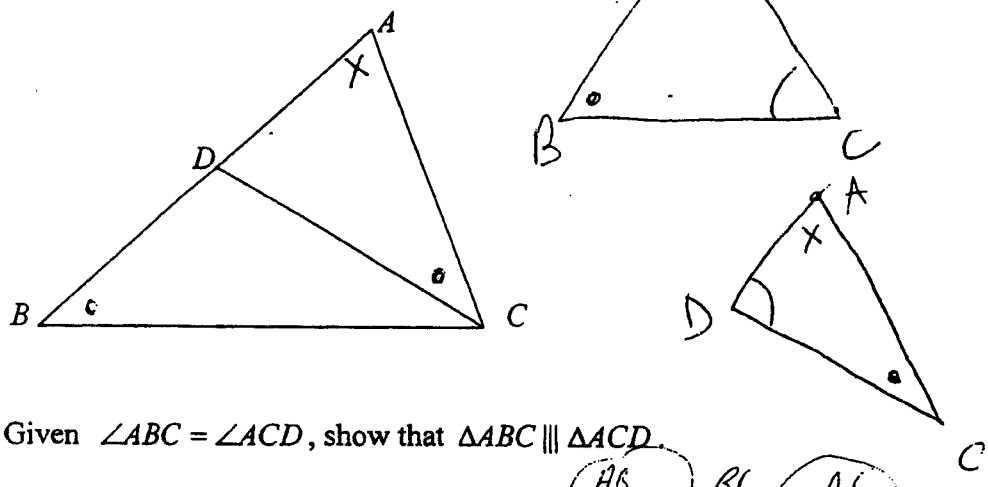
(i) Show that $\Delta ADE$ is an isosceles triangle. **3**

(ii) Show that $DB = EC$. **1**

**Question 9(d) is on the next page.**

Question 9 (continued)

(d)




**Mark**

(i) Given $\angle ABC = \angle ACD$, show that $\Delta ABC \,|||\, \Delta ACD$. **2**

(ii) Hence show that $AC^2 = AB \times AD$. **2**

(iii) Find the length of $AB$ if $AC$=6cm, $AD$=4cm. **1**

**Question 10** (12 marks) Use a SEPARATE Writing Booklet.

(a) Show that $2\sin x - \cos^2 x + 2 = (\sin x + 1)^2$ **2**

(b) (i) Write down an expression for the discriminant of the quadratic equation $x^2 + 5x + a^2 = 0$. **1**

(ii) Hence, find the value(s) of $a$ for which the function $f(x) = x^2 + 5x + a^2$ is positive definite. **2**

(c) A ship sails from port $A$, 30km due East to port $B$. It then sails a further 18km in the direction $155^0$T to port $C$.

(i) Draw a neat sketch of the above information. **1**

(ii) Show that $\angle ABC = 115^0$. **1**

(iii) Find the distance from port $A$ to port $C$, correct to the nearest metre. **2**

(iv) Find the bearing of port $C$ from port $A$, correct to the nearest degree. **3**

**End of Paper.**

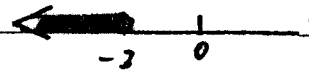
# YEAR 11 MATHEMATICS YEARLY EXAM 2002

1.(a) 6.89

(b) $1-3x>10$

$-3x>9$

$x<-3$ ✓




✓

(c) $\sin 300° = -\sin 60°$

$= -\sqrt{3}/2$ ✓

(d) $4.1 \times 10^{-3}$ ✓

(e) $\frac{2x}{3} - \frac{x+1}{4} = 1$

$8x - 3x - 3 = 12$ ✓

$5x = 15$

$x = 3$ ✓

(f) $\frac{1}{1-\sqrt{2}} \times \frac{1+\sqrt{2}}{1+\sqrt{2}} = \frac{1+\sqrt{2}}{1-2}$

$= -1-\sqrt{2}$

(g) $y = -x + b$ ✓

2(a) $|-7| - |-9| = 7-9$

$= -2$

(b) $\frac{1}{2} - \frac{1}{1/2} = -1\frac{1}{2}$.

(c) $x=0$ $y=1/2$

$y=0$ $x=4/3$

$A = \frac{1}{2} \cdot \frac{4}{3} \cdot \frac{1}{2}$ ✓

$= \frac{1}{3}$ (sq units) ✓

(d) $|x-3|>2$

$x-3<-2$, $x-3>2$

$x<1$ ✓ $x>5$ ✓

(e) $r = \sqrt{5^2+7^2}$

$= 8$

$x^2 + y^2 = 64$.

f) $x+y+1+k(2x-y-4)=0$

$3+1+k(6-4)=0$

$k=-2$. ✓

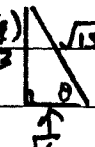
$x+y+1-2(2x-y-4)=0$ ✓

$x+y+1-4x+2y+8=0$

$-3x+3y+9=0$

$x-y-3=0$ ✓

3(a)




$\tan\theta = -\frac{3}{\sqrt{2}}$

(b) $\frac{\sin(90-\theta)}{\sin(180-\theta)} = \frac{\cos\theta}{\sin\theta}$ ✓

$= \cot\theta$. ✓

(c) $\sin\theta = -0.5$

"$\theta$" $= 30°$ | 3rd 4th ✓

$\theta = 210°, 330°$ ✓

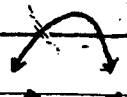
(d) $l^2 = 15^2 + 15^2 - 2.15.15\cos 37°$ ✓

$= 450 - 23.95\ldots$

$= 20.64\ldots$ (24)

$= 21$ cm. ✓

(e)(i)

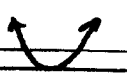



✓

(ii)

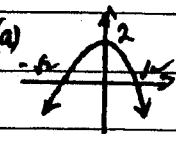

✓

(iii)

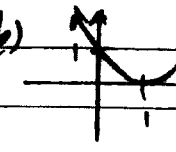



✓

4(a)



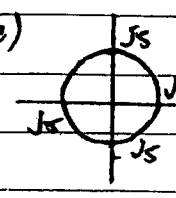

(b)



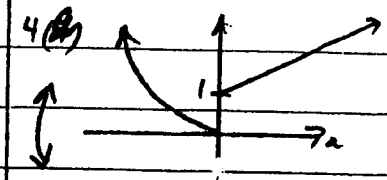

1 – for shape

1 – for scale (position)

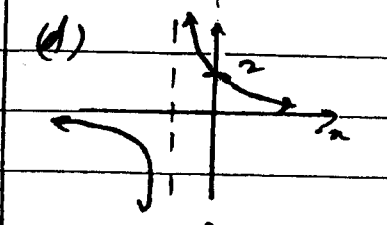
(c)



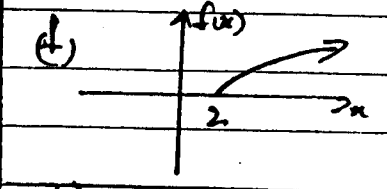

4(a)




(d)




(f)




5. (a) $y = x^2 + \frac{1}{3}x^{-3}$

(i) $\frac{dy}{dx} = 2x - x^{-4}$ ✓ ✓

(ii) $y = \frac{x}{2x-1}$

$\frac{dy}{dx} = \frac{(2x-1).1 - x.2}{(2x-1)^2}$ ✓

$= \frac{-1}{(2x-1)^2}$ ✓

(iii) $y = (x^2-x)^4$

$\frac{dy}{dx} = 4(x^2-x)^3.(2x-1)$

✓ ✓

(iv) $y = x^3(x-1)^5$

$\frac{dy}{dx} = x^3.5(x-1)^4.1 + (x-1)^5.3x^2$ ✓ ✓

$= x^2(x-1)^4(5x + 3x - 3)$

$= x^2(x-1)^4(8x-3)$ ✓

(b)(i) $f(x)$ is linear (or example) or $f(x)$ is a horizontal line

(ii) $f(x)$ is a str. line (or eg.)

(iii) $f(x)$ is odd.

6 (a)(i) $PQ = \sqrt{(6+2)^2+(4-2)^2}$

$= 10.$ ✓

(ii) $M\left(\frac{2+-4}{2}, \frac{-2+6}{2}\right)$ ✓

$(-1, 2).$

(iii) $y - -3 = \frac{2+3}{-1-4}(x-4)$ ✓

$y+3 = -x+4$

$y = -x+1$ (or variation) ✓

(b) $y-5 = -\frac{1}{3}(x-1)$

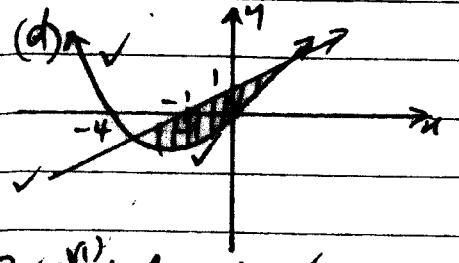
$y = -\frac{1}{3}x + 5\frac{1}{3}$

or $x+5y-26=0.$

(c) $d = \frac{|1.1 + -1.-2-6|}{\sqrt{(-1)^2+1^2}}$ ✓✓

$= \frac{3}{\sqrt{2}}$ ✓ or $\frac{3\sqrt{2}}{2}$

(d)




✓ ✓

7 (a)(i) $\alpha+\beta = -1$ ✓

(ii) $\alpha\beta = 1$ ✓

(iii) $\frac{\beta+\alpha}{\alpha\beta} = \frac{-1}{1} = -1$ ✓ ✓

(iv) $(\alpha+\beta)^2 - 2\alpha\beta = (-1)^2 - 2$

$= -1.$ ✓

(b) $y = x^2 + x$

$\frac{dy}{dx} = 2x+1$ ✓

(i) $m = -1$ ✓

(ii) $y = -x+b$ ✓

different $0 = 1+b$ ✓

quadrant $\therefore y = -x+1$

$x+y-1=0$ ?

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

$x^2 = 1$

$x = \pm 1$

meets at $(1, 2)$ ✓

8. (a)(i) $x^4+125x = x(x^3+125)$

$= x(x+5)(x^2-5x+25)$ ✓✓

(ii) $40x^2+11x-2$ | $x-80$

$= 40x^2+16x-5x-2$ | $+11$ | $16, -5$

$= 8x(5x+2)-(5x+2)$

$= (8x-1)(5x+2)$ ✓✓

(iii) $100-(40-t)^2$

$(10-40+t)(10+40-t)$

$(t-30)(50-t).$ ✓✓

(b) $x^2-4 \neq 0$ ✓

$\therefore x \neq \pm 2,$ ✓

A: all real $x$, except $x = \pm 2.$

(c) $x = \frac{10}{2} = 5.$

$f(5) = 25-50+21$

$= -4 \Leftarrow$ Min value.

(d) $x^2-2x+4 = 7$

$x^2-2x-3 = 0$

$(x-3)(x+1) = 0$

$x = 3, -1$

9 (a) $(3^x-1)(3^x-9) = 0$

$3^x = 1 \quad 3^x = 9$

then $x = 0$ ✓ $x = 2$ ✓ 2

(b) $-1 \leq \cos x \leq 1.$ ✓ 1

(c)(i) $\angle ABC = \angle ACB$ (base $\angle$s isos. $\triangle$) ✓

$\angle ADE = \angle ABC$ (corresponding $\angle$s $DE \parallel BC$) ✓

$\therefore AB = AC$ $\angle AED = \angle ACB$ (corresponding $\angle$s $DE \parallel BC$) ✓ 3

$\therefore \angle ADE = \angle AED$ (from above) ✓

ie. $\triangle ADE$ is isos. (base $\angle$s equal)

(ii) $AB = AC$ (sides of isos $\triangle A$)

$AD = AE$

$DB = EC$ (by subtraction)

can use (i) but needs to add sides equal first to get ratio $\therefore \frac{AB}{AC}$

if using (i) they needs to write correct ratio + then say $\therefore AB = AC$ then $DB = EC$ from ratio.

Q5 how DEFB is an isos. also happen

142

9. (a) In Δ's ABC & ACD.

(i) ∠BAC = ∠CAD (common) ✓

∠ABC = ∠ACD (given)

∴ ∠ACB = ∠ADC (angle sum of Δ). ✓ 2

ΔABC ||| ΔACD (equiangular). ✓

(ii) $\frac{AC}{AD} = \frac{AB}{AC}$ ✓ (corresponding sides of similar Δ's). 2

$AC^2 = AD.AD$.

(iii) $6^2 = AB.4$

$\underline{AB = 9}$ ✓ 1

10(a) LHS $= 2\sin x - \cos^2 x + 2$ ✓

$= 2\sin x - (1 - \sin^2 x) + 2$

$= \sin^2 x + 2\sin x + 1$ ✓

$= (\sin x + 1)^2$

(b) (i) $A = 25 - 4a^2$

(ii) $25 - 4a^2 < 0$, $a > 0$.

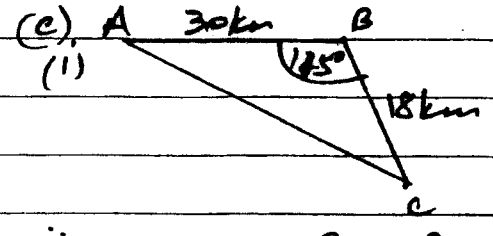
$4a^2 > 25$ ✓

$a^2 > 25$

$a < -5$, $a > 5$ and $a > 0$. $a > 5/2$.

$\therefore \underline{a > 5}$ ✓

(c) (i)




(ii) ∠ABC = 270° − 155° ✓

= 115°

(iii) $AC^2 = 30^2 + 18^2 - 2.30.18\cos 115°$ ✓

= 1680.42...

$\underline{AC = 50m}$. ✓

(iv) $\frac{\sin A}{18} = \frac{\sin 115°}{50}$ ✓

$\sin A = \frac{18\sin 115°}{50}$ ✓

= 0.326...

$\underline{A = 19°}$. ✓

EH

EDB

**KNOX GRAMMAR SCHOOL**
MATHEMATICS DEPARTMENT

**2002**
**YEARLY EXAMINATION**

# Mathematics
# Year 11

Total marks (**120**)

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using blue or black pen
- Board-approved calculators may be used
- All necessary working should be shown in every question
- **Attempt Questions 1–10**
- All questions are of equal value
- Use a separate Writing Booklet for each question
- An answer booklet must be handed in for each question.
- If a question is not attempted please write N/A on th front of the answer booklet

BLANK PAGE

**Total marks (120)**
**Attempt questions 1 – 10**
**All questions are of equal value**

Answer each question in a SEPARATE Writing Booklet. Extra Writing Booklets are available.

---

**Marks**

**Question 1** (12 marks) Use a SEPARATE Writing Booklet.

(a) Find the value of $(2^{0.7}+1)^2$ correct to two decimal places. **1**

(b) Solve $1-3x>10$ and graph the solution on the number line. **2**

(c) Give the exact value of $\sin 300^0$ **2**

(d) Express the answer to $0.0034 \times 1.2$ in scientific notation, correct to 2 significant figures. **1**

(e) Solve for $x$: $\frac{2x}{3}-\frac{x+1}{4}=1$ **2**

(f) Find integers $a$ and $b$ such that $\frac{1}{1-\sqrt{2}}=a-\sqrt{b}$. **3**

(g) Write down the equation of the straight line inclined at 135° to the positive $x$ axis. **1**