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BRIGIDINE COLLEGE RANDWICK

MATHEMATICS

YEAR 11

HALF-YEARLY

2003

(TIME - 1.5 HOUR)

DIRECTIONS TO CANDIDATES

* *Put your **name** at the top of this paper and on each of the **6 sections** that are to be collected.*
* *All 6 questions are to be attempted.*
* *All 6 questions are of equal value.*
* *All questions are to be answered on **separate pages** and will be collected in **separate bundles at the end of this exam.***
* *All necessary working should be shown in every question.*
* *Full marks may not be awarded for careless or badly arranged work.*

Question 1 (Start a new page)

a. $\dfrac{\sqrt{41.6 + 39.5}}{0.52 + 321}$ (correct to 3 significant figures) 2 m

b. Simplify as one fraction with a Rational Denominator $\dfrac{\sqrt{2}}{\sqrt{2}} \times \dfrac{2}{\sqrt{2}} + \dfrac{\sqrt{2}}{2}$ 2 m

c. Evaluate $|-3 \times 4 + 5| + |4 \times 6|$ 2 m

d. Completely factorise

i. $x^2 - 12x + 20$ 2 m

ii. $3x^2 + 11x - 4$ 2 m

iii. $\dfrac{1}{2}x^3 - 4$ 2 m

hint: consider rewriting this in the form $\dfrac{1}{2}(\ldots\ldots)$

Question 2 (Start a new page)

a. Express $3.\dot{2}6\dot{5}$ (ie. 3.2656565 ...) as a fraction in its simplest form. 2 m

b. Completely simplify

i. $2\sqrt{63} + 5\sqrt{28} - \sqrt{343}$ 3 m

ii. $(x + 3)(x - 3) - (x - 1)^2$ 2 m

c. Solve the following equations

i. $\frac{3x - 2}{6} - \frac{1}{3} = 4$ 2 m

ii. $x(x + 7) + 4(x + 7) = 96$ 3 m

Question 3 (Start a new page)

a. Completely simplify

i. $\frac{x^2 - 9}{x^2 - x - 12} \times \frac{x^2 - 9x + 20}{x^2 - 3x}$ 3 m

ii. $\frac{5}{a^2 - 3a - 4} - \frac{3}{a^2 - a - 2}$ 3 m

b. Solve for x if $\left|\frac{4x + 2}{5}\right| \leq 2$ 3 m

c. Solve the following simultaneous equations

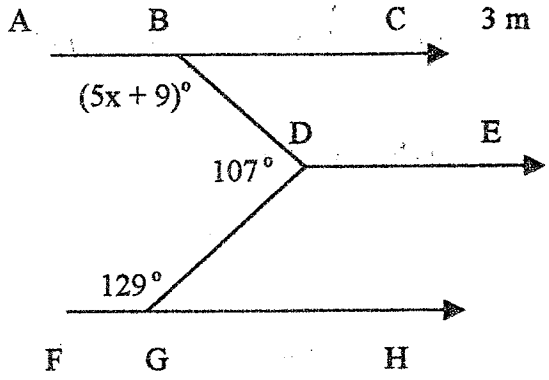
$x - y + 3 = 0$ and $xy = 10$ 3 m

Question 4 (start a new page)

a. Redraw this figure to the right on to your exam page.

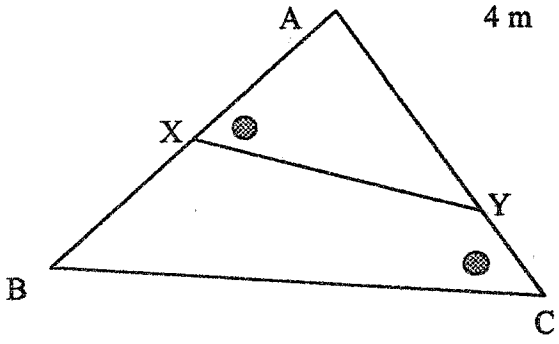
AC // DE // FH

Find the value of x, giving reasons to support your answer.



b. In this figure to the right, <AXY = < ACB. 4 m

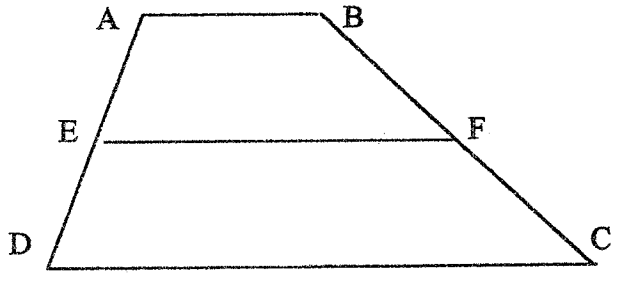
Redraw this figure onto your exam page.



i. Prove that $\Delta AXY \;///\; \Delta ACB$.

ii. On your diagram show the following information: AX = 6 cm, BX = 8 cm and AY = 10 cm. Determine the length of YC.

c. To the right is the trapezium ABCD, AB // DC. A line EF is drawn parallel to AB such that AE = ED. 4 m



i. Redraw this figure onto your exam page showing this information. Construct a line XY through the point F such that AXYD forms a parallelogram.

ii. By considering congruent triangles, prove that BF = FC.

d. Find the value of θ if $\sin\theta = \frac{1}{2}$ and θ is acute. 1 m

Question 5 (start a new page)

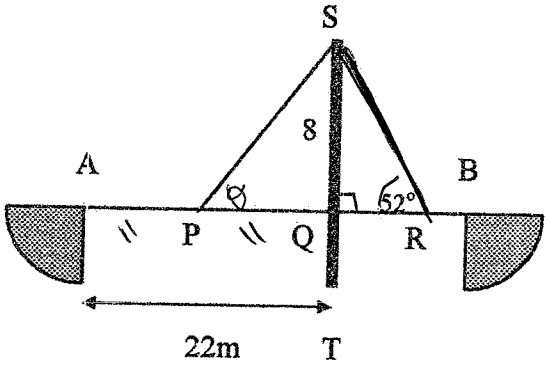
a. Find the exact value of $\tan 300^{\circ}$. 2 m

b. Find the value of θ for $0^{\circ} \leq \theta \leq 360^{\circ}$, if

i. $\sin\theta = -\frac{1}{2}$ 2 m

ii. $2\cos\theta + \sqrt{3} = 0$ 3 m

c.



A horizontal bridge is built between points A and B. The bridge is supported by cables SP and SR, which are attached to the top of a vertical pylon ST.

The section of the pylon, SQ, above the bridge is 8 metres long and $\angle SRQ = 52^{\circ}$.

The distance AQ is 22 metres and P is the midpoint of AQ.

i. Find the length of the cable SR to the nearest centimetre. 3 m

ii. Find the size of $\angle SPQ$ to the nearest degree. 2 m

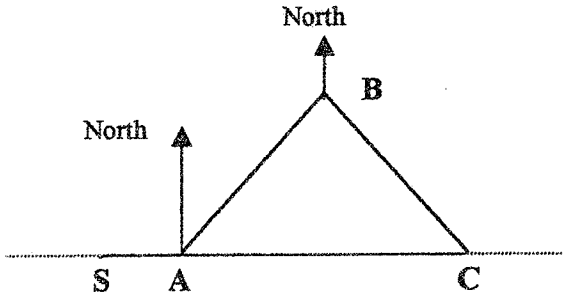
Question 6 (start a new page)

a. Determine the size of each interior angle of a regular 12-sided polygon. 2 m

b. Find the value of x if $\sin(x+20)^\circ = \cos 30^\circ$. 1 m

c. Prove that $\dfrac{\tan\theta}{\sec\theta - 1} - \dfrac{\tan\theta}{\sec\theta + 1} = 2\cot\theta$ 3 m

d. From the start **S**, Sharon rode 3 km due east to **A**. At **A**, she proceeded on a bearing of 055° for 10 km to **B**. At **B**, she changed course to a bearing of 130° and continued in this direction until she reached the finish at **C**. (**C** is due east of the start **S** and **A**)



i. Copy this diagram onto your answer sheet and display this information. 1 m

ii. Show that $\angle ACB = 40^\circ$. 1 m

iii. Find the distance from **B** to **C** (nearest km). 2 m

iv. It took Sharon 24 minutes to travel from the start to the finish. What was her average speed in km / hr? 2 m

2UNIT – PRELIM

a) 0.0280 ✓✓

$(0.028 = 1\text{mark})$.

$\frac{\sqrt{2}}{\sqrt{2}} \times \frac{2}{\sqrt{2}} + \frac{\sqrt{2}}{2}$ ✓

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

$= \frac{3\sqrt{2}}{2}$ ✓

) $|-3\times4+5| + |4\times6|$

$|-7| + |24|$

$7+24$

$= 31$ ✓✓

i) $(x-10)(x-2)$ ✓✓

i) $3x^2+11x-4$

$3x \quad -1$

$x \quad +4$

$(3x-1)(x+4)$ ✓✓

) $\frac{1}{2}(x^3-8)$

$\frac{1}{2}(x^3-2^3)$ ✓

$\frac{1}{2}(x-2)(x^2+2x+4)$ ✓

a)

$x = 3\cdot2656565\cdots$ ①

$10x = 32\cdot656565\cdots$ ②

$100x = 326\cdot5656\cdots$ ③

$1000x = 3265\cdot6565\cdots$ ④

④ − ②

$990x = 3233$ ✓

$x = 3\frac{263}{990}$

b) i) $2\sqrt{63} + 5\sqrt{28} - \sqrt{343}$

$2\times\sqrt{9}\times\sqrt{7} + 5\sqrt{4}\times\sqrt{7} - \sqrt{49}\times\sqrt{7}$ ✓

$6\sqrt{7} + 10\sqrt{7} - 7\sqrt{7}$ ✓

$9\sqrt{7}$ ✓

ii) $(x+3)(x-3) - (x-1)^2$

$x^2 - 9 - (x^2 - 2x + 1)$ ✓

$x^2 - 9 - x^2 + 2x - 1$

$2x - 10$ ✓

c) i) $\frac{3x-2}{6} - \frac{1}{3} = 4$

$3x - 2 - 2 = 24$ ✓

$3x - 4 = 24$

$3x = 28$

$x = \frac{28}{3}$ or $9\frac{1}{3}$ ✓

ii) $x(x+7) + 4(x+7) = 96$

$x^2 + 7x + 4x + 28 = 96$

$x^2 + 11x - 68 = 0$ ✓

$x = \frac{-11 \pm \sqrt{11^2 - 4\times1\times-68}}{2\times1}$

$= \frac{-11 \pm \sqrt{393}}{2}$ ✓✓

Q3a) i)

$\frac{x^2-9}{x^2-x-12} \times \frac{x^2-9x+20}{x^2-3x}$

$\frac{(x-3)(x+3)}{(x-4)(x+3)} \times \frac{(x-4)(x-5)}{x(x-3)}$ ✓✓

$\frac{x-5}{x}$ ✓

ii) $\frac{5}{a^2-3a-4} - \frac{3}{a^2-a-2}$

$\frac{5}{(a-4)(a+1)} - \frac{3}{(a-2)(a+1)}$ ✓

$\frac{5(a-2) - 3(a-4)}{(a-4)(a+1)(a-2)}$

$\frac{5a - 10 - 3a + 12}{(a-4)(a+1)(a-2)}$

$\frac{2a+2}{(a-4)(a+1)(a-2)}$ ✓

$\frac{2(a+1)}{(a-4)(a+1)(a-2)}$

$= \frac{2}{(a-4)(a-2)}$ ✓

b) $\left|\frac{4x+2}{5}\right| \leq 2$

$-2 \leq \frac{4x+2}{5} \leq 2$ ✓

$-10 \leq 4x + 2 \leq 10$

$-12 \leq 4x \leq 8$

$-3 \leq x \leq 2$ ✓✓

c) $x - y + 3 = 0 \cdots$ ①

$xy = 10 \cdots$ ②

from ① $y = x + 3$ sub in ②

$x(x+3) = 10$

$x^2 + 3x - 10 = 0$ ✓

$(x+5)(x-2) = 0$

$x = -5 \quad x = 2$ ✓

$y = -2 \quad y = 5$ ✓

$= -\sqrt{3}$ —②

b) i. $\sin 30° = 1/2$

$\therefore \theta = 210°, 330°$ —②

ii. $\cos\theta = -\sqrt{3}/2$

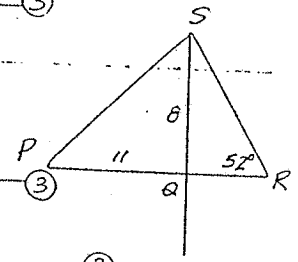
$\cos 30° = \sqrt{3}/2$

$\theta = 150°, 210°$ —③

c) i. $\frac{8}{SR} = \sin 52°$

$SR = 10.152\ldots$ m

$= 1015$ cm —③



ii. $\tan S\hat{P}Q = 8/11$

$\therefore S\hat{P}Q = 36°$ —②

Q6 a) $\frac{(12-10)\times 180}{12} = 150°$ —②

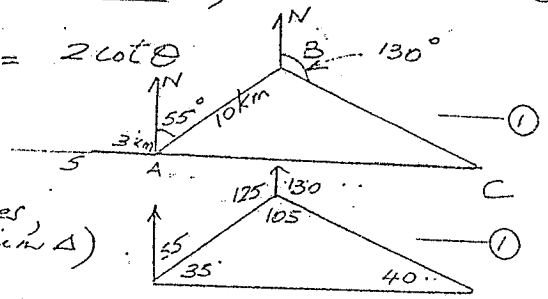
b) $x + 20 = 30$ ie. $x = 10$ —①

c) LHS $\frac{\tan\theta}{\sec\theta - 1} - \frac{\tan\theta}{\sec\theta + 1}$ allow max 2 for use of a correct trig. sub.

$= \frac{\tan\theta(\sec\theta+1) - \tan\theta(\sec\theta-1)}{\sec^2\theta - 1}$ —③

$= \frac{2\tan\theta}{\tan^2\theta} = 2\cot\theta$

d)



—①

ii. $\angle ACB = 40°$

(co-int $\angle$'s in // lines, $\angle$'s at a pt, $\angle$ sum Δ)

—①

iii. Sin Rule: $\frac{BC}{\sin 35} = \frac{10}{\sin 40}$

$BC = 8.92\ldots$ km ie. 9 km.

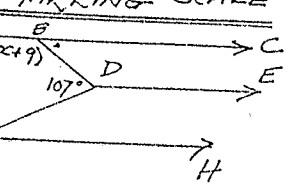
iv. Sharon travelled $3 + 10 + 9 = 22$ km —②

$\therefore$ av. speed $= 22/(24/60)$ km/h

$= 55$ km/h. —②

03 MA 2U PRELIM 1/2 YLY. ANS & MARKING SCALE

04/ a) Correct redraw —①



$\angle GDE = 129°$ (alt $\angle$'s in // lines) ✓

$\angle BDE = (5x+9)°$ (✓

$\angle BDE + \angle GDE + \angle EDG = 360°$ ✓

($\angle$'s at a pt.)

ie $(5x+9) + 129° + 107° = 360°$ ✓

$\therefore x = 23$

Correct reasoning —①

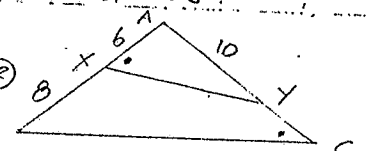
Answer —①

OR extend ED to Y & use co-int $\angle$'s.

b) i) In Δ's AXY, ACB

$\angle AXY = \angle ACB$ (given) ✓

$\angle XAY = \angle BAC$ (common) ✓ —②



$\therefore \Delta AXY \,|||\, \Delta ACB$ (equiangular)

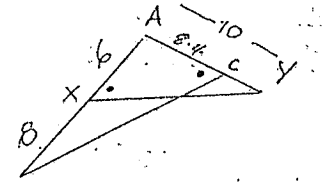
(ii) $\frac{AC}{AX} = \frac{AB}{AY}$ (corr. sides in sim. Δ's) —①

i.e. $\frac{AC}{6} = \frac{14}{10}$ ①

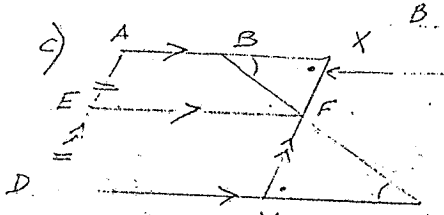
$\therefore AC = 8.4$ (impossible if C lies on AY extended)

However if C is between A & Y then result OK.

$\therefore CY = 1.6$



c)



—① (construction)

In Δ's BXF, CYF

$\angle BXF = \angle FYC$ (alt $\angle$'s in // lines)

$\angle XBF = \angle FCY$ (alt $\angle$'s in // lines)

$XF = FY$ ($XF = AE$ opp sides // gram AXFE

$ED = FY$ ✓ ✓ ✓ EFYD

and $AE = ED$ (given) ✓

or equal intercept theorem)

$\therefore \Delta BXF \equiv \Delta CYF$ (AAS) —②

(d) $\sin\theta = \frac{1}{2}$

$\therefore \theta = 30°$ —①