

AUSTRALIAN CATHOLIC UNIVERSITY

Castle Hill

Semester I

ST201: Mathematics for Science Teachers

LECTURER: W N Franzsen

April 1993

TIME ALLOWED: 1 hour for a section or 2 hours for two or three sections

INSTRUCTIONS TO STUDENTS

*There are three sections to this exam, section 1 has 7 questions, section 2 has 8 and section 3 has 5. You may attempt as many sections as you like. Answer each section you attempt in a separate booklet. **At the end of the first hour I will collect your attempt at section TWO**, or section 3 if that is the only section you are attempting. After that you can either leave quietly or continue your attempts at the other sections.*

All the questions are worth equal marks

Remember that you only have to pass each section. So do not panic if you do not finish a section, you may have done enough.

Calculators are permitted.

Please hand in all your rough work with your attempts, it may be worth marks.

SECTION 1

1. Expand the following expressions.

(a) $(z + 2)(x - y) + yz$

(b) $x(x^2 + x^3) - x(x - x^2)$

(c) $(x - y - z)(y - x + z)$

(d) $\left(\frac{1}{2}x + \frac{1}{3}y\right)\left(2y + \frac{1}{5}x\right)$

(e) $(a + b)(a^2 - ab + b^2)$

2. Factorise as far as possible.

(a) $7x^2y - 14xy^2 + 35x^3y^4$

(b) $8a^4b^2 + ab^5$

(c) $51x^2 - 3xy$

(d) $x^2 + 2x$

(e) $27 + y^3$

3. Rearrange the following equations to make y the subject.

(a) $x = 3y + \frac{1}{4}$

(b) $x = \frac{y + 2}{7}$

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

(d) $x^2 = y^2 - 1$

4. Factorise each of the following quadratics (if possible of course).

(a) $x^2 + 7x + 6$

(b) $x^2 - 7x + 12$

(c) $x^2 + 3x + 2$

(d) $x^2 - 324$

(e) $x^2 + x + 1$

(f*) $4x^2 + 5x + 6$

5. Solve the following quadratic equations (again if possible).

(a) $x^2 + 5x - 6 = 0$

(b) $x^2 + 4x + 4 = 0$

(c) $x^2 + 3x - 5 = 0$

(d) $x^2 + x + 12 = 0$

6. Simplify the following expressions.

(a) $\sqrt{3}(\sqrt{6} + \sqrt{5}) - (3\sqrt{2} + \sqrt{7})$

(b) $\sqrt{6} \times \sqrt{12} \times \sqrt{8}$

(c) $\sqrt{8x^3 - 4x^2}$

7. Complete the square for the following expressions.

(a) $x^2 + 6x + 11$

(b) $x^2 + 2x - 19$

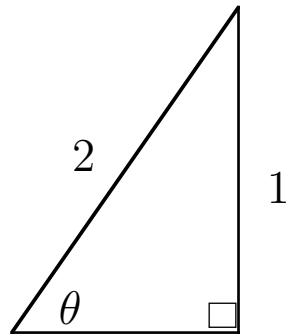
(c) $x^2 + 5x + \frac{1}{4}$

(d) $2x^2 + 8x - 9$

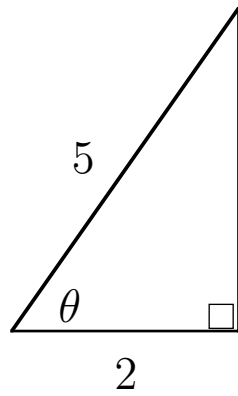
SECTION 2

8. Find $\sin \theta$, $\cos \theta$ and $\tan \theta$ for each of the following angles.

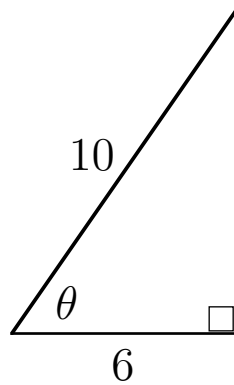
(a)



(b)



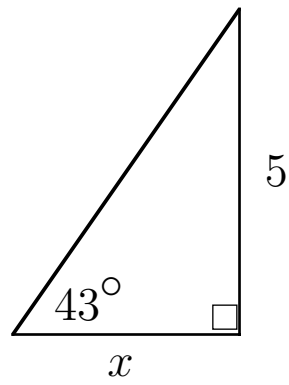
(c)



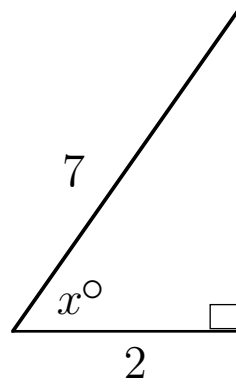
9. If $\tan \theta = \frac{1}{3}$ what does $\cos \theta$ equal?

10. Find x .

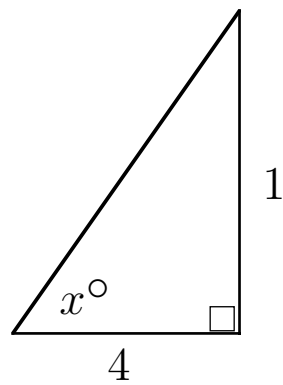
(a)



(b)

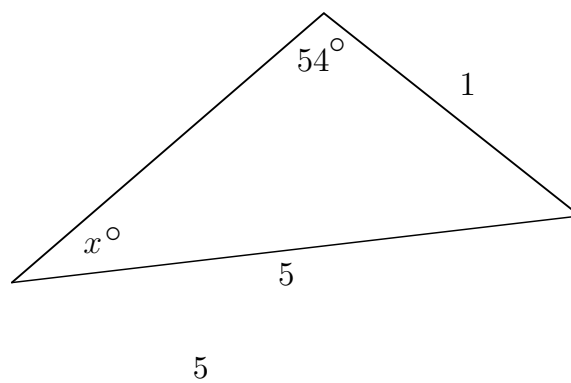


(c)

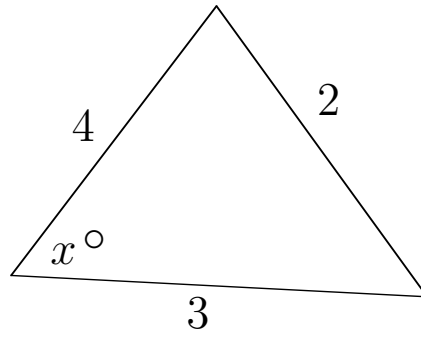


11. Find x .

(a)

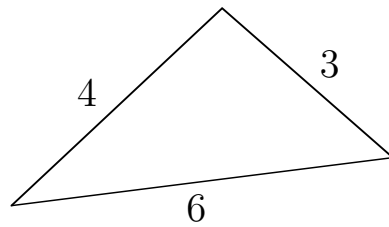


(b)

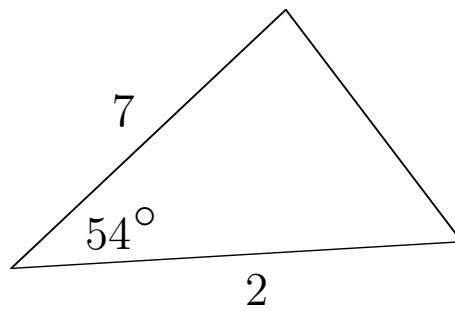


12. Find the areas of the following triangles.

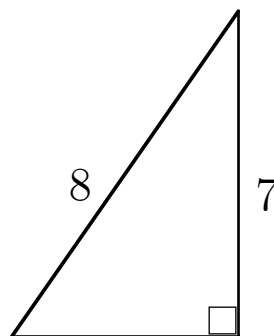
(a)



(b)



(c)



13. Write down the values of the following

$\sin 60^\circ$, $\cos 60^\circ$, $\sin 30^\circ$, $\cos 30^\circ$ and $\sin 45^\circ$.

(Note that using your calculator is not going to be enough.)

14. Simplify the following expressions.

(a) $\frac{\sin^2 x + \tan x \cos x}{\sin x + \cos x}$

(b) $\frac{\sin x \cos x}{\cos^2 x - 1}$

15. Given that

$$\sin(a + b) = \sin a \cos b + \sin b \cos a$$

evaluate the following

(a) $\sin 105^\circ$

(b) $\cos 105^\circ$

(c) $\sin 135^\circ$

(Note that using your calculator is not going to be enough.)

SECTION 3

16. Sketch the graph of each of the following lines.

(a) $y = x + 4$

(b) $y = -2x + 7$

(c) $y = 2x - 9$

(d) $x = 1$

17. Sketch the graph of each of the following quadratics.

(a) $y = x^2 + 5x + 4$

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

(c) $y = x^2 + x + 5$

18. Sketch the graph of each of the following trigonometric functions.

(a) $y = 3 \sin 2x$

(b) $y = \cos 3x$

19. Convert to polar coordinates.

(a) $x = 3y + 7$

(b) $x^2 + y^2 = 7$

(c) $x^3 + 3y^2 = 9x$

20. Sketch the following graph in polar coordinates.

$$r = \cos 2\theta.$$