Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Remainder and factor theorem

Time allowed: 1 hour 20 minutes

Subject code **0606**

Additional Mathematics

Questions from Paper 1 and Paper 2

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
Questions 1, 4, 6-7, 9 (Paper 1): no calculator.
Questions 2-3, 5, 8 (Paper 2): calculator allowed.

Total marks

/ 52

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 9 questions worth 52 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 The remainder when the expression $x^3 + kx^2 - 5x - 3$ is divided by $x - 2$ is 5 times the remainder when the expression is divided by $x + 1$. Find the value of k. [4]

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2 It is given that $\mathrm{p}(x) = ax^3 - 7x^2 - bx + 9$, where a and b are constants.
$x - 3$ is a factor of $\mathrm{p}(x)$.
When $\mathrm{p}(x)$ is divided by $x + 2$ the remainder is -35.

Find the values of a and b. [5]

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3 The expression $x^3 + 8x^2 + px - 25$ leaves a remainder of R when divided by $x - 1$ and a remainder of $-R$ when divided by $x + 2$.

(i) Find the value of p. [4]

(ii) Hence find the remainder when the expression is divided by $x + 3$. [2]

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4 The function f is such that $f(x) = 4x^3 - 8x^2 + ax + b$, where a and b are constants. It is given that $2x - 1$ is a factor of $f(x)$ and that when $f(x)$ is divided by $x + 2$ the remainder is 20. Find the remainder when $f(x)$ is divided by $x - 1$. [6]

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5 It is given that $x - 1$ is a factor of $f(x)$, where $f(x) = x^3 - 6x^2 + ax + b$.

(i) Express b in terms of a. [2]

(ii) Show that the remainder when $f(x)$ is divided by $x - 3$ is twice the remainder when $f(x)$ is divided by $x - 2$. [4]

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6 The function $f(x) = ax^3 + 4x^2 + bx - 2$, where a and b are constants, is such that $2x - 1$ is a factor. Given that the remainder when $f(x)$ is divided by $x - 2$ is twice the remainder when $f(x)$ is divided by $x + 1$, find the value of a and of b. [6]

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7 $p(x) = 2x^3 + 5x^2 + 4x + a$

$q(x) = 4x^2 + 3ax + b$

Given that $p(x)$ has a remainder of 2 when divided by $2x + 1$ and that $q(x)$ is divisible by $x + 2$,

(i) find the value of each of the constants a and b. [3]

Given that $r(x) = p(x) - q(x)$ and using your values of a and b,

(ii) find the exact remainder when $r(x)$ is divided by $3x - 2$. [3]

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8 The polynomial $\mathrm{p}(x) = mx^3 - 29x^2 + 39x + n$, where m and n are constants, has a factor $3x - 1$, and remainder 6 when divided by $x - 1$. Show that $x - 2$ is a factor of $\mathrm{p}(x)$. [6]

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9 A polynomial $\mathrm{p}(x)$ is $ax^3 + 8x^2 + bx + 5$, where a and b are integers. It is given that $2x - 1$ is a factor of $\mathrm{p}(x)$ and that a remainder of –25 is obtained when $\mathrm{p}(x)$ is divided by $x + 2$.

(i) Find the value of a and of b. [5]

(ii) Using your values of a and b, find the exact solutions of $\mathrm{p}(x) = 5$. [2]

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