1. Solving equations and inequalities

(a) $\dfrac{x^2-x-2}{x^2+5x+6} \le 0$

(b) $\dfrac{x}{x^2+4x-5}+\dfrac{3}{x^2-25} \le \dfrac{2x}{x^2-6x+5}$

(c) $\left|1+\dfrac{1}{x}\right| < 3$

(d) $\ln x + \ln(x-1) = 1$

(e) $\ln(5-2x) = -3$

(f) $2^{x-5} = 3$

2. Arithmetic and Geometric Sequences

(a) Max, an investment counselor, sets up an investment situation for a client that will return $5000 the first year, $6125 the second year, $7250 the third year, and so on, for 25 years. How much is received from the investment altogether? 462500

(b) Hadleytown has a present population of 100,000, and the population is increasing by 3% each year.

a. What will the population be in 15 years?

151259

b. How long will it take for the population to double?

24.25 yrs

3. Partial fractions

(a) $\dfrac{2x^3+3x^2-11x-10}{x^2+2x-3}$

(b) $\dfrac{-4x^2-2x+10}{(3x+5)(x+1)^2}$

4. Properties of Functions

(a) Determine whether f is even, odd, or neither even nor odd

a. $f(x) = 2x^5 - 3x^2 + 2$ neither

b. $f(x) = x^3 - x^7$ odd

c. $f(x)=e^{-x^2}$ even

d. $f(x)=1+\sin x$ neither

(b) If $f(x)=2x+\ln x$, find $f^{-1}(2)$ and $f(f(1))$.

$f^{-1}(2)=1$ $f(f(1))=4+\ln 2$

(c) Find the domain and range of the function

a. $f(x)=\sqrt{4-3x^2}$ $x\in\left[\frac{-2}{\sqrt{3}},\frac{2}{\sqrt{3}}\right]$

b. $f(x)=\frac{1}{1+x}$ $x\in(-\infty,-1)\cup(-1,\infty)$

c. $f(x)=\ln(\ln x)$ $x\in(1,\infty)$

(d) Let $f(x)=\begin{cases}\frac{|x+2|}{x^2-4}, & x\neq 3\\ 1, & x=3\end{cases}$

a. Sketch the graph of *f*

b. Determine whether *f* is continuous at *x = 3*.

Yes; *f* is continuous at *x* = 3

c. Compute $\lim_{x\to 2^+} f(x)$ and $\lim_{x\to 2^-} f(x)$

$\lim_{x\to 2^+} f(x)=+\infty$ $\lim_{x\to 2^-} f(x)=-\infty$

d. Compute $\lim_{x\to -2^+} f(x)$ and $\lim_{x\to -2^-} f(x)$

$\lim_{x\to -2^+} f(x)=-\frac{1}{4}$ $\lim_{x\to -2^-} f(x)=\frac{1}{4}$

e. Find the vertical and horizontal asymptotes of f if any.

H.A: $y=0$

V.A: $x=2$

5. **Finding Limits**

(a) $\lim_{x\to 0}\sqrt{\dfrac{2x^3+3x^2-11x-10}{3x^2+2x-3}}$

ANS: $\sqrt{\dfrac{10}{3}}$

(b) $\lim_{x\to \infty}\sqrt{\dfrac{2x^3+3x^2-11x-10}{3x^3+2x-3}}$

ANS: $\sqrt{\dfrac{2}{3}}$

(c) $\lim_{x\to \infty}\ln\left(2+\dfrac{1}{x^2}\right)$

ANS: $\ln(2)$

6. Counting Principles

(a) A football team consists of 3 players who play in a defense position, 3 players who play in a midfield position and 5 players who play in a forward position. Three players are chosen to collect a gold medal for the team. Find in how many ways this can be done

a. If the captain, who is a midfield player, must be included, together with one defense and one forward player;

$${}_3C_1\times {}_5C_1=15$$

b. If exactly one forward player must be included, together with any two others

$${}_5C_1\times {}_6C_2=75$$

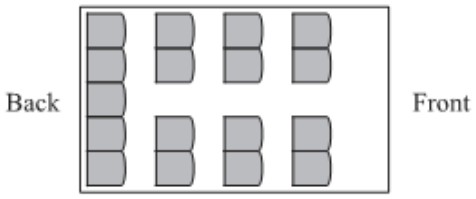
(b) Find how many different arrangements there are of this nine letters in the words GOLD MEDAL

a. If there are no restrictions on the order of the letters;

$$\frac{9!}{2!2!}=90720$$

b. If the two letters D come first and the two letters L come last

$${}_5P_5=120$$



The diagram shows the seating plan for passengers in a minibus, which has 17 seats arranged in 4 rows. The back row has 5 seats and the other 3 rows have 2 seats on each side. 11 passengers get on the minibus.

(i) How many possible seating arrangements are there for the 11 passengers? [2]

(ii) How many possible seating arrangements are there if 5 particular people sit in the back row? [3]

Of the 11 passengers, 5 are unmarried and the other 6 consist of 3 married couples.

(iii) In how many ways can 5 of the 11 passengers on the bus be chosen if there must be 2 married couples and 1 other person, who may or may not be married? [3]

(i) ${}_{17}P_{11} = 494010316800$

(ii) ${}_{12}P_{6} \times 5! = 79833600$

(iii) ${}_{3}C_{2} \times {}_{7}C_{1} = 21$