

SMASK

S.6 REVISION WORK TERM 1 APPLIED MATHEMATICS P425/2

1. A ship P is moving due west at 12kmh^{-1} . The velocity of a second ship Q relative to P is 15kmh^{-1} in a direction 30° west of south.
Find the velocity of ship Q.

2. (a) Show graphically that the equation $e^{2x} + 4x - 5 = 0$ had only one real root between 0 and 1.
(b) Use the Newton – Raphson iterative method to find the root of the equation in (a) above giving your answer correct to 2 decimal places.

3. A tennis player hits a ball at a point O, which is at a height of 2m above the ground and at a horizontal distance 4m from the net, the initial speed being in a direction of 45° above the horizontal. If the ball just clears the net which is 1m high,
(a) Show that the equation of path of the ball is $16y = 16x - 5x^2$.
(b) Calculate the;
(i) distance from the net at which the ball strikes the ground.
(ii) magnitude and direction of the velocity with which the ball strikes the ground.

4. A random variable X has a continuous probability density function (p.d.f) given by

$$f(x) = \begin{cases} c(x+1) & 0 < x < 2 \\ \frac{3cx}{2} & 2 \leq x < 4 \\ 0 & \text{Elsewhere} \end{cases}$$

Where c is a constant.

- a) Sketch the graph of $f(x)$. Hence find the value of c.
b) Determine the cumulative density function (c.d.f) $F(x)$. Hence find the
(i) Median
(ii) $P(1.5 < X \leq 3)$

5. Given that $M = 8.542, N = 4.6$ rounded off to the given number of decimal places.

- a) State the maximum possible error in M and N.

Determine the interval with in which the value of $M - \frac{M}{N}$ lies.

- b) Show that the maximum relative error in the function \sqrt{MN} is given by $\frac{1}{2} \left(\frac{|\Delta M|}{M} + \frac{|\Delta N|}{N} \right)$ where $|\Delta M|$ and $|\Delta N|$ are the respective errors in M and N. Hence calculate the percentage relative error in finding \sqrt{MN} .

6. Given that $\tan 30^\circ = 0.577$ and

$\tan^{-1}(1.321) = 52.87^\circ$, use linear interpolation or extrapolation to find the value of;

- a) $\tan^{-1}(0.865)$
b) $\tan 60^\circ$

7. A and B are events such that $P(A) = \frac{8}{15}$, $P(B) = \frac{1}{3}$, and $P(A/B) = \frac{1}{5}$. Find the probability that;
(i) neither A nor B occurs
(ii) Event B does not happen if event A has occurred

8. ABCD is a parallelogram. Forces of magnitude 6N, FN and $13\sqrt{2}$ N act along the sides AB, AD and AC respectively in the direction indicated by the order of the letters. Given that angle ADC = 60° , find the value of F and the size of angle BAC.

9. A class contains 18 girls of which 6 are left handed, 12 boys of which 5 are left handed. A group of 5 pupils is selected at random from the class. Find the
i) probability that at most 2 are girls
ii) expected number of left handed pupils in the group.

10. A particle Q moves such that its displacement from the origin at any time t is given by $(r = 4t^2i + 2tj - 5k)\text{m}$. Find the
(i) Speed of the particle at $t = 3\text{s}$
(ii) acceleration of the particle at any time.

11. The price index of an article in 2000 based on 1998 was 130. The price index for the article in 2005 based on 2000 was 80. Calculate the;

- a) price index of the article in 2005 based on 1998
b) price of the article in 1998 if the price of the article was 45,000 in 2005.

12. Forces of magnitude 5N and PN are acting away from each other at

an angle of 60° . Given that their resultant is 7N, find the:

- (i) value of P
(ii) angle P makes with the resultant
13. A discrete random variable X has a cumulative distribution function (c.d.f) given below

x	1	2	3
F(x)	β	4β	9β

Find the value of β and the mean of x

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14. A particle of weight 20N is on a rough plane. Given that a force of 10N acting away from the plane at 20° to the line of greatest slope is just sufficient to prevent it from sliding down and the frictional force experienced by the particle is 8N, find the angle of inclination of the plane and the reaction between it and the particle.

15. (a) On the same axes, draw a curve $y = xe^x$ and a line $y = x + 1$ to show that the function $xe^x - x - 1 = 0$ has a root in the interval 0 and 1.

(b) Use the Newton Raphson method to find the root of the equation correct to 3 decimal places.

16. The marks scored in an exam are normally distributed with mean 56 and standard deviation 14.2. Find the probability that a candidate picked at random scored

- (i) between 62 and 72 marks.
- (ii) at least 40 marks.

17. Forces of $(3i + 13j)N$, $(2i - j)N$ and $(-i - 4j)N$ act at points with position vectors $(i + j)M$, $(3i + 2j)M$, and $(-3i + 5j)M$. Find the;

- (a) magnitude of the resultant force.
- (b) the equation of its line of action.

18. $X \sim B(n, p)$ with mean 5 and standard deviation 2. Find the value of n and p .

19. Find the approximate value of $\int_0^1 \frac{1}{x^2 + \sin x} dx$ using six ordinates.

20. (a) Show that the iterative formula based on Newton Raphson formula for finding the root of the equation

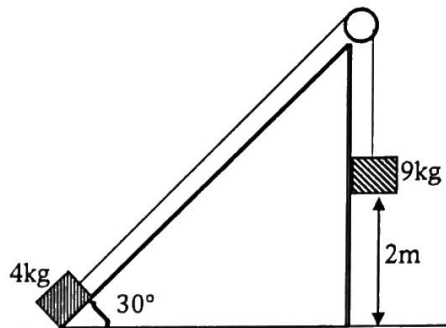
$$X = \sqrt[4]{N} \text{ is given by } x_{n+1} = \frac{1}{4} \left(3x_n + \frac{N}{x_n^3} \right) \quad n=1, 2, 3 \dots$$

- (b) Construct a flow chart that
 - (i) Reads N and the first approximation x_0
 - (ii) Computes and prints the root to three decimal places or after exactly 4 iterations

Taking $N = 85, x_0 = 3.0$ perform a dry run for the flow chart. Give your root correct to **three** decimal places.

21. Particles of mass 4, 6, 3 and 5kg act at the vertices A, C, B and D respectively of a rectangle ABCD, with $AB = 6 \text{ cm}$ and $AD = 4 \text{ cm}$. Find the coordinates of the centre of mass of the particles.

22. Two masses of 4 kg and 9 kg are connected by a light inextensible string passing over a smooth pulley at the edge of the smooth inclined plane of inclination 30° as shown below. If the system is released from rest,



- Calculate the
- (i) acceleration of the system
 - (ii) tension in the string
 - (iii) Reaction on the pulley at the edge of the inclined plane.
 - (iv) Maximum displacement of the 4kg mass up the plane.

23. The table below shows the ages in years of workers on a certain firm.

Age (years)	15-	20-	30-	35-	50-	60-	65-	70-
Frequency density	0.4	0.5	1.6	0.2	0.3	0.8	1.0	0.0

- a) Represent the above data on a histogram, hence estimate the modal age.
- b) Calculate the
 - (i) Mean age
 - (ii) Variance

24. The brakes of a train, which is travelling at 108 km h^{-1} are applied as the train passes point A. The brakes produce a constant retardation of magnitude $3f \text{ ms}^{-2}$ until the speed of the train is reduced to 36 km h^{-1} . The train travels at this speed for a distance and is then uniformly accelerated at $f \text{ ms}^{-2}$ until it again reaches a speed of 108 km h^{-1} as it passes point B. The time taken by the train in travelling from A to B, a distance of 4km, is 4 minutes.

- (a) Sketch the speed-time graph for this motion
- (b) Calculate;
 - (i) the value of f
 - (ii) the distance travelled at 36 km h^{-1}

END