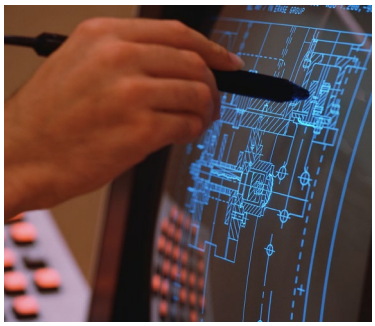
LINEAR EQUATIONS
APPLICATIONS
ENGINEERING AND BIOMECHANICS



ACCELERATION	FINAL VELOCITY	FORCE
A = (V – U) ÷ T	**V = U + A x T**	**F = M x A**
A = acceleration (m/s^2) V = final velocity (m/s) U = initial velocity (m/s) T = time (seconds)	V = final velocity (m/s) U = initial velocity (m/s) A = acceleration (m/s^2)	F = force (Newtons) M = mass (kilograms) A = acceleration (m/s^2)
WORK	**PRESSURE**	**POWER**
W = F x D	**Pressure = F ÷ A**	**Power = W ÷ T**
W = work (Joules) F = force (Newtons) D = distance (metres)	Pressure (Pascals) F = force (Newtons) A = area (m^2)	Power (Watts) W = Work (Joules) T = Time (seconds)

Q1. A 1300 kg Ferrari car accelerates (speeds up) from start (0 m/s speed) to 100km/h (27.8 m/s) in 4 seconds. What is its acceleration (in m/s^2)?

Q2. In a high jump run-up, an athlete accelerates from a standing start (0 m/s) to 10 m/s in 2 seconds. What is her acceleration?

Q3. To escape Earth's gravity, the escape velocity must be 8000 m/s. If the rocket reaches this final velocity on 20 seconds after lift-off, what is its acceleration?

Q4. Transpose (rearrange) the Acceleration formula to make U the subject of the formula.

Q5. Find the time (in seconds) for a motorbike that accelerates at 5 m/s^2 to go from 20 m/s to 30 m/s.

Q6. A sprinter can accelerate at 5 m/s^2 at the start of a race. When the starter gun fires, a sprinter leaves the blocks and reaches top speed in 2 seconds. What is the maximum speed?

Q7. Calculate the final speed V using information in the table below.

	Initial speed (m/s)	Acceleration (m/s^2)	Time (s)	Final speed (m/s)
(a)	0	5	10	
(b)	20	6	4	
(c)	35	10	3	

Q8. A baseball pitching machine throws a 0.5 kg baseball a distance of 20 metres. What force was used?

Q9. Transpose the Force formula to make M the subject of the formula.

Q10. Your weight is actually the force of gravity on your body by planet Earth. If your mass is 50 kg and the gravitational acceleration on Earth is 10 m/s^2, use the F=MxA formula to calculate your weight in Newtons.

The power of imagination makes us infinite.
John Muir

Q11. A person with a weight of 600 Newtons walks up a hill 20 metres high. What work is done?

Q12. A chocolate bar contains 1800 kilojoules of energy. If the person in Q11 ate the chocolate bar and then walked up and down the hill to walk this off, how many times would he have to do this?

Q13. A Hummer vehicle has a mass of 2700 kg (a weight of 27 000 Newtons). The contact area of the four tyres with the road is 1.2 m^2. What is the tyre pressure required so they don't go flat?

Q14. Why will a karate hit with the side of the hand hurt more than an open-handed slap?

Q15. What is the power (in kilowatts) of a machine that gives out 200 Joules of energy in 1 hour?

Q16. Transpose the Power formula to make Work the subject of the formula.

Q17. (a) If your mass is 70 kg and the gravitational acceleration on Earth is 10 m/s^2, use the F = M A formula to calculate your weight in Newtons.
(b) Imagine you run or walk up a stairs that are 5 metres high. Use the Work formula to work out what work you do.
(c) If you go up the stairs in 4 seconds, what is your power?

ANSWERS

Q1. 6.95

Q2. 5 m/s^2

Q3. 400 m/s^2

Q4. U = V – AT

Q5. 2

Q6. 10 m/s

Q7. (a) 50
(b) 44
(c) 65

Q8. 10 N

Q9. M = F ÷ A

Q10. 500

Q11. 12000 Joules or 12kJ

Q12. 75 times up and down

Q13. 22500 Pascals or 22.5 kP

Q14. Smaller area of karate hit so greater pressure

Q15. W = Power ÷ T

Q16. 720

Q17. (a) 700 N
(b) 3500 J
(c) 875 W