Assignments 1-4 The Greatest Hits

1. a) Sketch the graphs of $y = \arcsin(x)$ and $y = \arccos(x)$ on the same diagram, $-1 \leq x \leq 1$

b) Use your sketch to state an approximate solution to the equation

$$\arcsin(x) = \arccos(x), \qquad -1 \leq x \leq 1$$

c) Find an exact solution to the equation

$$\arcsin(x) = \arccos(x), \qquad -1 \leq x \leq 1$$

2. A frequency distribution is shown below

Class interval	1-20	21-40	41-60	61-80	81-100
Frequency	5	10	15	12	8

Use interpolation to find an estimate for the interquartile range

3. Find an expression in terms of x and y for $\frac{dy}{dx}$, given that

a) $x^2 + y^3 = 2$ *b)* $y^3 + 3x^2y - 4x = 0$

c) $e^x y = xe^y$ *d)* $\sqrt{xy} + x + y^2 = 0$

4. A girl cycles from Appledore to Benfield and then from Benfield to Charlesville. The displacement from Appledore to Benfield is 10**i** + 3**j** km. The displacement from Benfield to Charlesville is -7**i** + 12**j** km

a) Find the magnitude of the displacement from Appledore to Charlesville.

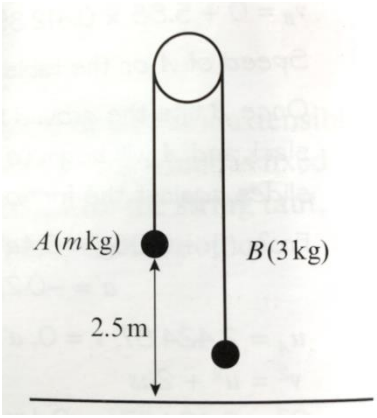
b) Find the total distance the girl has cycled in getting from Appledore to Charlesville.

c) Work out the angle that the vector from Appledore to Charlesville makes with the unit vector **i**.

5. A plank of wood *AB* has length 4 m and mass 40 kg . The plank is smoothly supported at *A* and at *C* , where *AC* = 3 m, as shown in the figure above.
A man of mass 80 kg stands on the plank at a distance *d* m from *A* .
The plank with the man standing on it remains in equilibrium with *AB* horizontal, and the reactions on the rod at *A* and at *C* equal.
The plank is modelled as a uniform rod and the man as a particle.
Determine the value of *d* .

6. A sector of a circle of radius 28 cm has perimeter P cm and area A cm^2. Given that A = 4P, find the value of P.

7. Two particles, A and B, have masses m kg and 3 kg respectively, where m > 3.
The particles are connected by a light inextensible string which passes over a smooth fixed pulley.
Initially A is 2.5 m above horizontal ground.
The particles are released from rest with the string taut and the hanging parts of the string vertical,
as shown in the figure.
After A has been descending for 1.25 s, it strikes the ground.
Particle A reaches the ground before B hits the pulley.



a) Find the acceleration of B as it ascends.

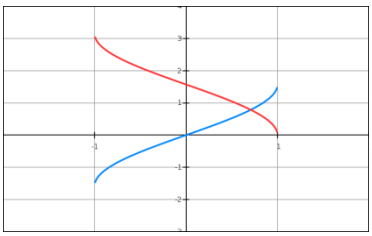
b) Find the tension in the string as A descends.

c) Find the value of m.

d) State how you have used the information that the string is inextensible.

When A strikes the ground it does not rebound and the string becomes slack.
Particle B then moves freely under gravity, without reaching the pulley, until the string becomes taut again.

e) Find the time between the instant when A strikes the ground and the instant when the string becomes taut again.

1. a) 

b) ≈ 0.7 c) $\frac{\sqrt{2}}{2}$

2. 37.5

3. a) $-\frac{2x}{3y^2}$ b) $\frac{4-6xy}{3x^2+3y^2}$ c) $\frac{e^x y-e^y}{xe^y-e^x}$ d) $\frac{-2\sqrt{xy}-y}{4y\sqrt{xy}+x}$

4 a) 15.3 m b) 24.3 m c) 78.7°

5. 1.25 m

6. 78.4

7. a) $3.2\ ms^{-2}$ b) 39 N c) $\frac{65}{11}$

d) The tensions are the same either side of the pulley e) $\frac{40}{49}\ s$