35 Emma takes out a home loan of \$120 000 at 7.2% p.a. interest compounded monthly. The loan is to be repaid over 20 years.

a Calculate the monthly repayment.

b Calculate the amount of money still owing on the loan after one year.

c **i** Calculate the amount paid in the first year of the loan.

ii By how much has the principal been reduced at the end of the first year?

iii Explain why the loan does not reduce by the full amount of your first year's repayment.

d Suppose that after 1 year, the interest rate falls to 6.95% p.a.

i Calculate the new monthly repayment.

ii If Emma is able to keep paying the original repayments, how much earlier will the loan be paid off?

36 Oscar decides to start a new business venture which involves taking out a bank loan. The bank charges an interest rate of 6.55% p.a. compounded quarterly.

His quarterly repayments are \$933.62, and must be repaid over 8 years.

a How much did Oscar borrow?

b How much interest will he pay over the 8 year period?

c **i** Calculate the outstanding balance at the end of the sixth year.

ii At the end of the 6th year, Oscar pays a lump-sum of \$3000 off the loan. Assuming his repayments remain the same, how much sooner will Oscar repay the loan?

37 Mary takes out a loan of \$10 000 to purchase a car. The bank charges an interest rate of 8% p.a. compounded monthly. Mary will repay the loan with quarterly repayments over 5 years.

a Calculate the quarterly repayment.

b Find the balance of the loan after 3 years.

c After 3 years, Mary decided she would like to have the loan paid off in 1 year's time. What must her quarterly repayment increase to for this to occur?

38 Cassie made an initial investment of €2000 into a savings account, and followed it with regular deposits of €500 per quarter.

The account pays 1.2% interest per quarter, and inflation is 0.3% per quarter.

a Explain why the real interest rate is approximately 0.9% per quarter.

b Find the real value of Cassie's investment after 5 years.

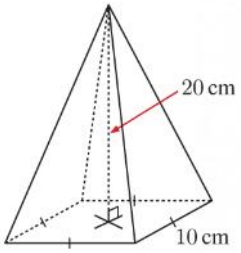
39 Bill collects \$81 000 as his share of a lottery win. He decides to retire from work and buy an annuity to provide \$2000 per month, until he gets a pension in four years' time.

a What annual interest rate, compounded monthly, is needed for Bill's plan to work?

b How much will Bill actually receive each month over the period of the annuity if he receives 7% p.a. interest compounded monthly?

2 Find the surface area of each solid:

a



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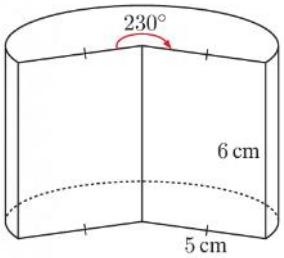
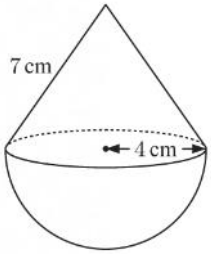
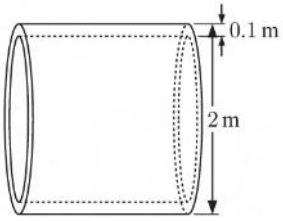


c



3 The surface area of a beach ball is $2800\ \text{cm}^2$. Find the radius of the beach ball.

4 A pipe used to drain stormwater is made from $3\ \text{m}^3$ of concrete. Find the length of the pipe.

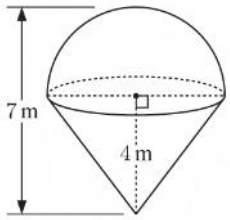


5 A sector of a circle of radius 10 cm has perimeter 40 cm. Find:

a the arc length of the sector

b the area of the sector.

6 A large artificial ice cream for a shop front display is to be made with a hemisphere on top of an inverted cone.



The total height of the structure is 7 m, and the cone is 4 m high.

a Show that the radius of the cone is 3 m.

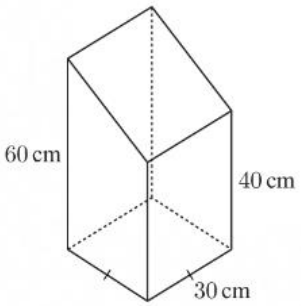
b Calculate the total volume of the ice cream.

c Find the slant height of the cone.

d Find the total surface area of the ice cream.

e The ice cream is to be made from a lightweight polymer, weighing 1.23 kg per m^2. Calculate the total weight of the ice cream.

8 How many of these petrol containers can be completely filled with 300 L of petrol?



9 For each pair of points, find:

i the distance AB **ii** the midpoint of [AB].

a $A(2, 4, 1)$ and $B(4, 0, 7)$ **b** $A(3, -5, 2)$ and $B(-1, 2, -3)$

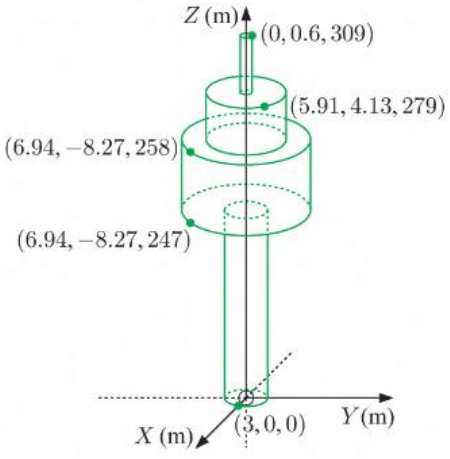
c $A(-6, 0, 5)$ and $B(-3, -3, 1)$

10 The distance from $P(k, 6, -5)$ to $Q(2, -1, -8)$ is 9 units. Find the possible values of k.

11 Suppose A is $(3, 4, -6)$, and $M\left(-\frac{1}{2}, 9, -7\right)$ is the midpoint of [AB]. Find the coordinates of B.

12 Sydney tower in Australia is the second tallest observation tower in the Southern Hemisphere.

Find the volume of the tower.



20 At 2:35 pm Fari sees an airplane directly overhead. At 2:38 pm he estimates that the angle of elevation to the plane is $15°$. The plane is travelling in a straight line at 110 m s^{-1}. Calculate:

a the height of the plane above the ground **b** the angle of elevation to the plane at 2:42 pm.

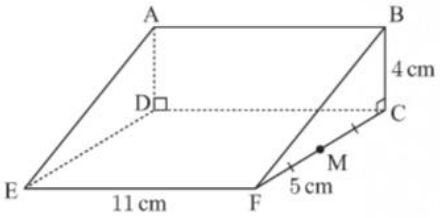
21 A helicopter lands 5 km east and 7 km south of its starting point.

a Find the helicopter's distance from its starting point.

b Find the helicopter's bearing from its starting point.

22 Find the angle between the following line segments and the base plane of the triangular prism:

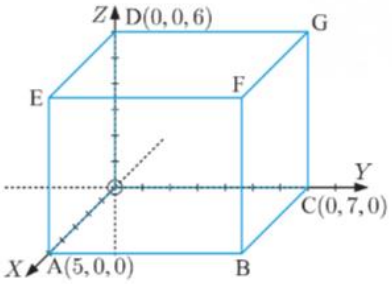
a [AE] **b** [BD] **c** [BE] **d** [AM]



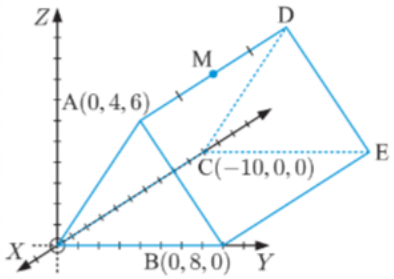
23 Consider the rectangular prism shown.

Find the angle between the following line segments and the base plane ABCO:

a [CD] **b** [OF] **c** [AG]



24



Consider the triangular prism shown.

a State the coordinates of M.

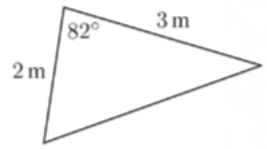
b Find the measure of $\widehat{\text{CMD}}$.

c Find the angle between the following line segments and the base plane BECO:

i [OD] **ii** [EM]

25 Find the area of:

a



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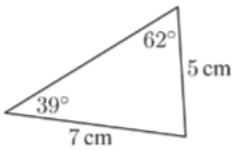

26 Triangle ABC has $\text{AB} = 8\text{ cm}$, $\text{BC} = 10\text{ cm}$, and $\text{AC} = 12\text{ cm}$.

a Draw a diagram clearly showing this information. **b** Find the smallest angle in triangle ABC.

c Find the area of triangle ABC.

27 In triangle ABC, $\text{AB} = 72\text{ cm}$, $\text{BC} = 61\text{ cm}$, and $\widehat{\text{ABC}} = 43°$.

a Calculate the length of AC. **b** Find the measure of $\widehat{\text{ACB}}$.